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Panicum sciurotoides, a New Species of *Panicum* (Poaceae: Paniceae) from America

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During a revision of Central and South American species of *Panicum* subg. *Dichanthelium*, the new species *P. sciurotoides* was discovered and is described below. This species will be included in the treatments of *Panicum* for the *Flora of the Guianas* and the *Flora of the Venezuelan Guayana*.

Panicum sciurotoides Zuloaga & Morrone, sp. nov. TYPE: Brazil. Minas Gerais: Districto Diamantina, Christais, near Corriga duas Pontes, 1,160 m, 13 May 1931, *Mexía 5819* (holotype, MO; isotypes, G, K, M, P, R). Figure 1a–h.

Species nostra *Panico sciurotidi* Trin. proxima, sed gluma inferiore ⅓–½ spiculae longitudine, 1–3(–7)-nervia, gluma superiore 7–9(–11)-nervia, lemma inferiore 7–9-nervia, basi non incrassata, et anthoecio superiore basi inserto notanda.

Annual. *Culms* decumbent, geniculate, rooting and branching at the lower nodes, erect portion 10–85 cm tall, branching at the upper nodes; internodes 2.5–11.5 cm long, terete, hollow, hispid to glabrous; nodes dark, compressed, densely pilose with retrorse whitish hairs. *Sheaths* striate, 3–6.5 cm long, sparsely papillose-pilose to glabrous, the margins ciliate or one margin ciliate and the other one membranous. *Ligules* membranous-ciliate, small, surmounted by long hairs at the base of the blade; collar pilose. *Blades* ovate-lanceolate, 3–10 cm long, 0.8–2 cm wide, flat, cordate, amplexicaulous and asymmetric basally, densely hirsute, with short to long appressed tuberculate hairs, to short-hispid on the abaxial surface or glabrous, the margins ciliate toward the base, otherwise scabrous. *Inflorescence* terminal, lax, diffuse, pyramidal, 2.5–9 cm long, 1.5–8.5 cm wide; *main axis* wavy, hirsute, with long papillose-pilose hairs; branches alternate, flexuous, the axis of the branches smooth, glabrous; pedicels long, glabrous. *Spikelets* solitary, long-ellipsoid, 1.5–1.9 mm long, 0.5–0.7 mm wide, greenish, short-hispid; upper glume and lower lemma subequal. *Lower glume* ovate, 0.4–0.9 mm long, usually ⅓–½ or more the length of the spikelet, acute to truncate, 1–3(–7)-nerved. *Upper glume* 7–9(–11)-nerved, not embracing the lower lemma. *Lower lemma* glumiform, 7–9-nerved, acute, not inflated at the base. *Lower palea* lanceolate to truncate, small, 0.7–1 mm long, 0.2–0.3 mm wide, hyaline, glabrous; lower flower absent. *Upper anthecium* ellipsoid, 1.2–1.7 mm long, 0.4–0.6 mm wide, smooth, shiny, short-apiculate, with simple papillae over its surface, inserted basally. *Caryopsis* 1.1 mm long, 0.7 mm wide.

Distribution and ecology: Widely distributed from Panama to Bolivia and Brazil; common at edge of forests, with the culms straggling in low vegetation, or in disturbed and open places in sandy soils; from 100 to 1,400 m.

Chromosome number: $2n = 18$ (Dubcovsky & Zuloaga, in prep.).

Additional specimens examined. BOLIVIA. La Paz: Hacienda Canana, sobre el camino a Tipuani, *Buchtien 7115* (BAA, G, US), *7116* (MO); 13.7 km NW of San Pedro on road through Incahuara-Mejillones, *Solomon 9523* (MO); Hacienda Simaco sobre el camino a Tipuani, *Buchtien 5319* (M, MO, US); San Carlos, Mapiri, *Buchtien 26* (BAA, US), *46* (US); Sinupaya bei Yanacachi, *Buchtien 414* (US); Prov. Murillo, 45.5 km below the dam at Lago Zongo, Zongo Valley, *Solomon 1300* (MO). BRAZIL. Alagoas: Porto de Pedras, Fazenda Canada, *Campelo 1444* (CTES). Bahia: Bom Jesús, *Luetzelburg*

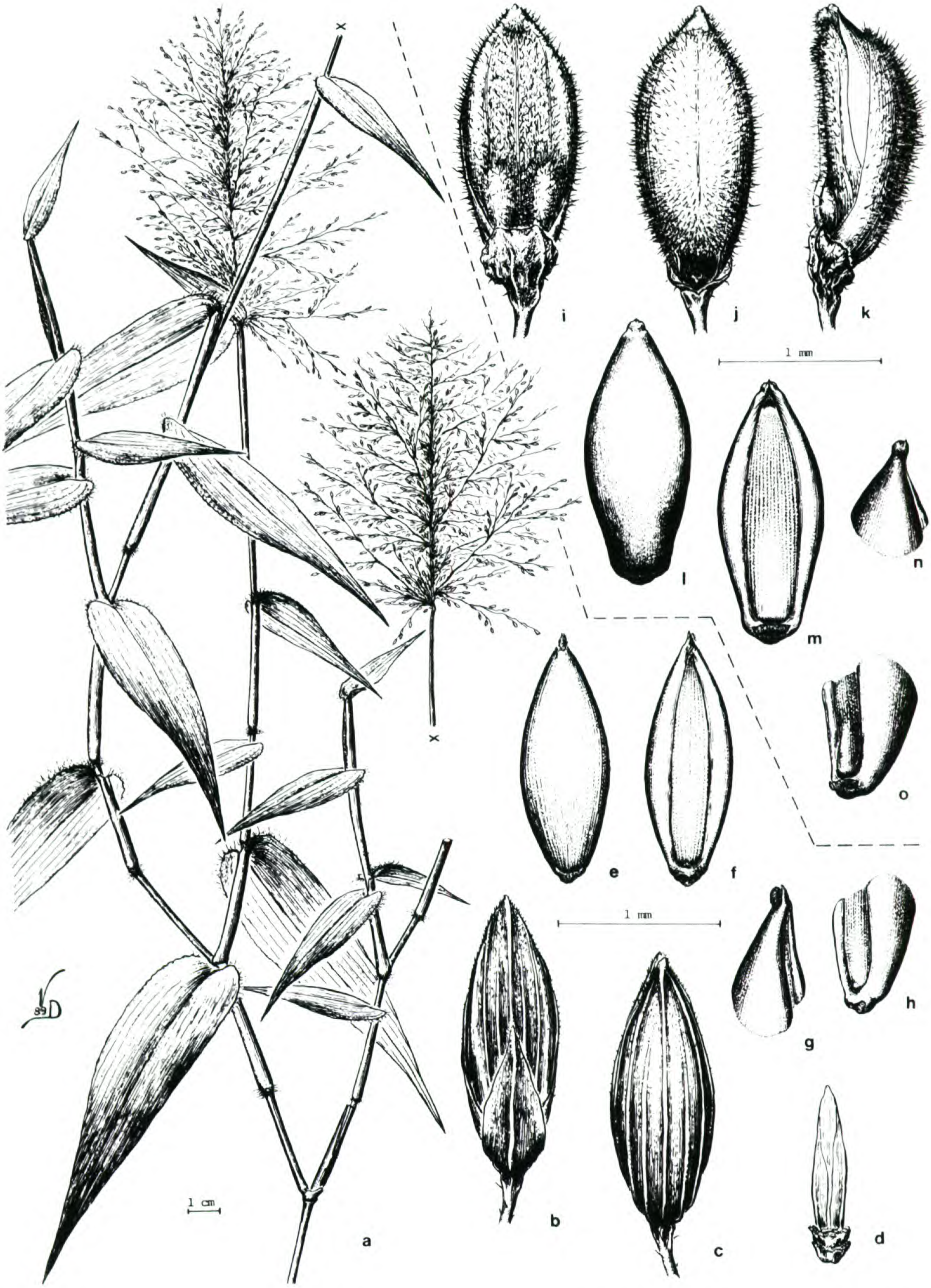

Figure 1. *Panicum sciurotoides* Zuloaga & Morrone —a. Habit. —b. Spikelet, ventral view. —c. Spikelet, dorsal view. —d. Lower palea. —e. Upper anthecium, dorsal view. —f. Upper anthecium, ventral view. —g. Upper portion of lemma. —h. Basal portion of lemma and palea. *Panicum sciurotis* Trin. —i. Spikelet, ventral view. —j. Spikelet, dorsal view. —k. Spikelet, lateral view. —l. upper anthecium, dorsal view. —m. upper Anthecium, ventral view. —n. Upper portion of lemma. —o. Lower portion of lemma and palea. (a–h based on *Hatschbach 14758* US; i–o based on *Emygdio 1663* R.)

135a (M); São Bento das Lages, *Luetzelburg 133* (K, M); 12 km N of Cachoeira, 225 m, *Chase 8082* (MO, US); sudoeste C.M., 12°29′S, 38°20′W, *Noblick et al. 2472* (CEPEC); Cruz das Almas, *Pinto 117* (US); Itiruçú, km 7 da Rodovía Itiruçú-Maracas (BA 554), *dos Santos et al. 3430* (CEPEC, MO); Olivença, *Renvoize & Carvalho 4307* (CEPEC); Santa Cruz Cabralia, Estaçao Ecológica do Pau-Brasil, cerca de 16 km W de Porto Seguro, *dos Santos 33* (CEPEC), *Souza Santos & Euponino 88* (CEPEC), *Brito & Vinha 26* (CEPEC, K, MO); Mun. Una, Fazenda Carsata, km 4 da rod. Una/Santa Luzía, *Hage et al. 1691* (CEPEC, K); Serra do Tombador, NW of Jacobina, on BR 234 highway to Ouro Branco, *Harley et al. 16636* (CEPEC, K, US); Olivença, *Renvoize & Carvalho 4307* (K); Serra da Agua de Rega, ca. 27 km N of Seabra, road to Agua de Rega, 1,000 m, *Irwin et al. 31023* (MO); Taperoa, Fazenda Bomfim, *Barbosa 18* (MO); without locality, *Salzmann 697* (G, P). CEARÁ: Barra do Cocó, *Black 55-18336* (IAN); Praia Naútica de Fortaleza, *Black 55-18347* (IAN). ESPÍRITO SANTO: Alfredo Chaves, Vila São Bento de Uranio, *Zuloaga et al. 2409* (RB, SI, US); Santa Teresa, Reserva Biológica de Nova Lombardía, Picada da Cachoeira, *Zuloaga et al. 2427* (RB, SI, US). MINAS GERAIS: Capão, Engenho Magueira, *Magalhaes s.n.* (IAN 13866); Diamantina, Serra de San Antonio, *Chase 10373* (US); ca. 1 km S of São Pedro do Suaçui along Highway MG-3, 520 m, *Davidse et al. 11495* (MO); Santana do Riacho, na estrada p/Lapinha, 4 km da cidade, 1,000 m, *Muniz et al. s.n.* (K); entre km 996–997, 5 de antigua linha de ferrovia Diamantina-Corinto, *Burman & Sendulsky 754, 778* (SP); Hargreaves, *Chase 10251* (US); Juiz de Forá, Morro do Imperador, *Chase 8571* (US); ao longo da rodovía Lagoa Santa-Conceição do mato Dentro, entre Alto dos Palácios e Conceição, *Burman 201, 208, 211* (SP); Mun. Ouro Preto, Ouro Preto, *Eiten 6929* (US); abandoned diamond mines, steep slopes of Rio Jequití, ca. 15 km E of Diamantina, *Irwin et al. 27933* (MO, P); SE drainage of Pico de Itambé, *Anderson et al. 35729* (MO); ca. 15 km N of São Joâo da Chapada, *Irwin et al. 28151* (F, K, MO, UB, US); Serra do Curral, SE of Belo Horizonte, *Chase 8958* (US); Serra do Espinhaço, ca. 8 km E of Diamantina, *Irwin et al. 27666* (K, MO, UB, US); Serra do Espinhaço, ca. 14 km E of Diamantina, *Irwin et al. 27543* (UB); Serra do Espinhaço, 15 km S of Diamantina, *Anderson et al. 35542* (MO, UB, US); Serra Sapucaia, *Magalhaes 15584* (IAN); Viçosa, *Chase 10187* (K, US), *Irwin 2311* (F, R, SI), *Kuhlmann 1948* (RB); *Mexía 4738* (G, K, MO, US); without locality, *St. Hilaire 323* (P), *Gaudichaud 12* (P). PARANÁ: Paranaguá, *Dombrowski 277* (K, US); Antonina, *Kuniyoshi 1612* (CTES, K); Sertao de Indaial, *Hatschbach 2496* (SI); Pinheirinho, Mun. Antonina, *Hatschbach 14758* (K, US); Porta do Sul, *Moreira Filho 416* (US); Mun. Antonina, Sapitanduva, *Hatschbach 32663* (K, MO); Pinhaes, *Dusén 14522* (MO). PERNAMBUCO: Dois Irmaos, vicinity of Pernambuco, *Chase 7732* (MO, US); SW of Garánhuns, 300–400 m, *Chase 7828* (MO); Itambé, *Vasconcellas & Sobrinho s.n.* (IAN 375003). RIO DE JANEIRO: Monte Serrat, Serra da Itatiaia, *Chase 8246* (IAN, MO, US); Parque Nac. Itatiaia, Picada Macieiras, *Zuloaga et al. 2349* (MO, RB, SI, US), *2354* (RB, SI, US); Resende, *Kuhlmann 276* (IAN, RB); Serra do Itatiaia, *Sampaio 4699* (IAN, R); without locality, *Glaziou 13316* (K). SANTA CATARINA: Piloes, *Reitz & Klein 3626* (G); Azambuja, Brusque, *Klein 2646* (HB); Mont. Iurapé, *Schwacke 13153* (RB); Mun. Brusque, Beco Osvaldo Nieburg, *Klein & Bresolin 11718* (HB); Barra Velha, arredores, *Paciornik 117* (K); without locality, *D'Urville s.n.* (P), *Schenck 229* (W). SÃO PAULO: halfway between Canasveia and Jacapiranga, *Davis et al. s.n.* (SP 146087); Caraguatuba, *Rombouts s.n.* (SP); Iguapé, Morro das Pedras, *Brade 7837* (R), *20368* (IAN); Campos do Jordão, *Hashimoto 331* (SP); 19 km SW of Juquitiba, along BR-2, *Clayton & Eiten 4666* (K, SP, US); São Jose do Barreiro, *Hoehne & Eiten 4741* (SP); Cananeia Island, 1 km NE of city along E shore of island, *Clayton & Eiten 4743* (K); near Santos, *Rose & Russell 21134* (US); Cananeia, Ilha do Cardoso, praia de Marujá, *da Silva 284* (MO); without state and locality, *Riedel 228* (G, K). ECUADOR. EL ORO: between La Chonta and Portovelo, *Hitchcock 21211* (US). TUNGURAHUA: Baños, *Pachano 228* (US). GUYANA. Forest along Potaro River, 4 mi. above Kaieteur Falls, *Cowan & Soderstrom 2109* (K, P, US). PANAMA. COCLÉ: trail from Caño Blanco del Norte to continental divide N of El Copé, *Davidse & Hamilton 23657* (SI); El Copé, along gravel road to the right, *Antonio 2194* (SI); along continental divide near sawmill above El Copé, *Knapp 3822* (SI). VENEZUELA. BOLÍVAR: 12 km al norte de La Ciudadela, Gran Sabana, 5°50′N, 61°27′O, *Zuloaga et al. 4475* (MO, SI, VEN); Salto El Dante, 35 km N of La Ciudadela on way down from La Gran Sabana, along highway to El Dorado, *Davidse 4951* (MO, SI, VEN); Gran Sabana, ca. 10 km SW of Karaurín tepui at junction of Río Karaurín and Río Asadón, *Liesner 23580* (MO); km 132.5 al S de El Dorado, 1,370 m, *Steyermark et al. 117547* (F, MO, VEN); bosque húmedo, La Escalera, km 126–134 sur de El Dorado, *Morillo et al. 8150* (VEN); entre Piedra de la Virgen y la parte alta de la Escalera, carretera a la Gran Sabana, 6°01′N, 61°25′O, *Zuloaga et al. 4399* (MO, SI, VEN); rocky exposed southwest-facing escarpment between Cerro Rancho Carata and Cerro El Picacho, *Steyermark 88596* (K, VEN); along road from Icabarú to Santa Elena, 70 km NE of Icabarú, 790 m, *Croat 54243* (MO). FALCÓN: cerca de Maraparari, *Lasser & Foldats 3005* (VEN). YARACUY: 7.5 km N of Salom, cloud forest, 10°15′N, 68°29′W, *Liesner & Steyermark 12373* (MO); 5 km N of Salom, transition between savanna and forest, *Davidse et al. 20674* (MO); Distrito Nirguá-Distrito San Felipe border, Cerro La Chapa, 7 km N of Nirguá by road, 68°35′W, 10°12′N, cloud forest, *Davidse et al. 20799* (MO); Cerro Picacho, norte de Nirguá, *Steyermark & Bunting 97638* (US); selva nublada virgen en la fila de la cumbre, El Amparo hacia Candelaria, a 7 km al norte de Salom, *Steyermark 106199* (MO, VEN).

Panicum sciurotoides is related to *P. sciurotis* Trin., from which it differs by having the lower glume ⅓–½ or more the length of the spikelet, 1–3(–7)-nerved, upper glume 7–9(–11)-nerved, lower lemma 7–9-nerved, not inflated at base, and upper anthecium inserted basally.

Panicum sciurotis Trin., Gram. Panic.: 228. 1826. TYPE: Brazil: "V. sp. Brasil," *Chamisso s.n.* (holotype, LE). Figure 1i–o.

Panicum rostellatum Trin., Mém. Acad. Imp. Sci. Saint Pétersbourg, Sér. 6, Sci. Math., Seconde Pt. Sci. Nat. 3(2): 288. 1834. TYPE: Brazil. Bahia: "In

arenosis prope Ilheos (Brasil) Sep. 1821," without collector, 232 (holotype, LE; fragment US-974732).

P. cordifolium Steudel, Syn. Pl. Glumac. 1: 85. 1854. Not Desv. 1831. *Panicum sciurotis* Trin. var. *breviglume* Doell, in C. Martius, Fl. Bras. 2(2): 250. 1877. TYPE: Paraguay, without locality, *Rengger s.n.* (holotype, P).

P. diffusulum Salzm. ex Steudel, Syn. Pl. Glumac. 1: 89. 1854. TYPE: Brazil. Bahia: without locality, in sabulosis umbrosis, *Salzmann 684* (holotype, P; fragments, US-967933, 974705, 2903510; isotypes, G, K, MO, P, W).

P. trichopiptum Steudel, Syn. Pl. Glumac. 1: 85. 1854. TYPE: Brazil. Bahia: without locality, *Salzmann s.n.* (lectotype, here designated, P; fragment, US-2903508).

P. sciurotis Trin. var. *molliusculum* Doell, in C. Martius, Fl. Bras. 2(2): 250. 1877. TYPE: Brazil: "in Insula S. Catharinae," *Chamisso s.n.* (lectotype, here designated, LE).

Annual. Culms geniculate, decumbent, rooting and branching at the lower nodes, then becoming erect, 5–25 cm tall; internodes hollow, compressed, hirsute, 2–8 cm long; nodes dark, densely pilose with retrorse whitish hairs. *Sheaths* striate, 1–5 cm long, hirsute, with long whitish hairs, the borders ciliate. *Ligules* membranous-ciliate, ca. 0.4 mm long; collar pilose, brownish. *Blades* ovate-lanceolate, 1.5–9 cm long, 0.8–2.8 cm wide, herbaceous, flat, hirsute, with papillose-pilose, rigid and short hairs, amplexicaulous, the margins ciliate, the midnerve inconspicuous. *Inflorescence* terminal, exserted; peduncle 5–7.5 cm long, wavy, hirsute; panicles lax, diffuse, 2–7 cm long, 1–5 cm wide; *main axis* wavy, papillose-pilose with long hairs; pulvini pilose; first-order branches divergent, alternate to opposite, the axis of the branches flexuous, smooth, glabrous or with scattered long hairs; pedicels smooth, glabrous. Axillary panicles present, similar to the terminal one. *Spikelets* solitary, ellipsoid, 1.5–1.7 mm long, 0.7–0.8 mm wide, hirsute, with short hairs; upper glume and lower lemma subequal or the upper glume shorter, with inconspicuous nerves. *Lower glume* 0.3–0.4 mm long, ¼ or less the length of the spikelet, nerveless, truncate, not embracing the upper glume at the base. *Upper glume* obtuse, 5(–7)-nerved, with the nerves anastomosed, obtuse, not covering the apex of the anthecium. *Lower lemma* glumiform, obtuse, slightly inflated at the base, 5-nerved, the nerves anastomosing toward the distal portion. *Lower palea* lanceolate, 0.9 mm long, 0.2 mm wide, hyaline, glabrous; lower flower absent. *Upper anthecium* ellipsoid, 1.4–1.5 mm long, 0.5–0.7 mm wide, glabrous, smooth and shiny, short-apiculate, with simple papillae over its surface, inserted laterally. *Caryopsis* obovoid; hilum punctiform; embryo ⅓ the length of the caryopsis.

Distribution and ecology: restricted to northeastern Brazil, where it grows in sandy soils, in open places or forest edges.

Additional specimens examined. BRAZIL. BAHIA: Bahia, *Chase 7901* (F, RB, SI, US, W); Cruz das Almas, *Pinto 941* (US); BR-116 area brejosa entre o retorno da C. Nova/Cidade Feira de Santana, *Noblick 2735* (K); Ilheos, *Riedel s.n.* (W); without locality, *Blanchet 193* (G, P), *Blanchet s.n.* (G); without collector (MO-2098691). CEARÁ: Campo Grande, *Swallen 4539* (RB, SI, SP, US); Campo Salles to Crato, *Swallen 4303* (K, R, SP); Serra do Araripe, *Luetzelburg 26101* (M, US); Serra do Araripe, Novo Exú, *Luetzelburg 26141* (M). PERNAMBUCO: Carvaru, *Tenorio 66-197* (US); Garánhuns, *Chase 7791* (US); vicinity of Recife, *Chase 7732 1/2* (US); Recife, *Tavares 788* (US). RIO GRANDE DO NORTE: Natal, *Swallen 4677* (SP, US); Nova Cruz to Montanhas, *Swallen 4823* (RB, SP, US); entre Parnamirim e S. José de Mipibú, *Emygdio 1663* (R, US); without locality, *Riedel s.n.* (K, M, P, US-974737).

The type locality of the species, Santa Catarina, Brazil, is probably erroneous, since *P. sciurotis* has only been found in northeastern Brazil in Ceará, Pernambuco, Bahia, and Rio Grande do Norte. The same is probably also true for the type material of one of its synonyms, *P. cordifolium*, which was originally cited as originating in Paraguay.

Panicum sciurotis differs from *P. sciurotoides* in having spikelets with the lower glume nerveless and truncate, the upper glume and lower lemma 5(–7)-nerved, with nerves not manifest, the upper anthecium inserted laterally in relation to the axis of the rachilla, and the lower lemma inflated at the base.

Panicum sciurotis and *P. sciurotoides* also have different anatomical features: in the first species the leaf thickness at mid-lamina is 90–130 μm, ribs and furrows are inconspicuous, contiguous vascular bundles are separated by 260–340 μm, and the bulliform cells are flattened and disposed in long groups, with all cells at the same level. In *P. sciurotoides* the leaf thickness at mid-lamina is 150–215 μm, ribs and furrows are conspicuous at the adaxial surface, contiguous vascular bundles are separated by 160–230 μm, and the bulliform cells are fan-shaped, with one or more large, inflated central cell or cells.

When describing *P. trichopiptum*, Steudel cited three specimens, one from Bahia collected by Salzmann, which conforms to the diagnosis of the species and is, therefore, designated as the lectotype. According to notes by Doell (1877: 251), the second specimen is probably *P. brevifolium* L. When describing *P. sciurotis* var. *molliusculum*, Doell cited five specimens for this variety, of which *Chamisso s.n.* is selected as the lectotype.

Panicum litigosum Steudel, a species often associated with *P. sciurotis*, is a synonym of *P. brev-*

ifolium L., an African species in Bahia, Brazil. The following type material of *P. litigosum* has been examined: "Bahia, in umbrosis, *Panicum diffusum*, *Salzmann s.n.*" (holotype, P; isotypes, P, W).

We express gratitude to Bruno Manara for the Latin diagnosis of the new species. The first author thanks the Guggenheim Foundation for a fellowship which enabled him to finish writing this paper at the Missouri Botanical Garden. Fieldwork was conducted with help from a grant from the National Geographic Society, #3964-88.

A New Species of *Williamodendron* (Lauraceae) from Southern Brazil

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Included among specimens recently received on loan or as gifts for identification from GUA and MBML were several collections representing an undescribed species of Lauraceae. Study of this material showed that they belong to the genus *Williamodendron*, a genus not previously recorded from southern Brazil. Included also were two fruiting collections. Because fruits and cupules were not yet known from *Williamodendron*, they are described here in some detail. Shape and size of the cupule indicate a close relationship between *Williamodendron* and *Mezilaurus*.

Williamodendron cinnamomeum van der Werff, sp. nov. TYPE: Brazil. Espírito Santo: Santa Teresa, property of Sr. Alberto Shepa, *Boudet Fernandes 2392* and *E. Bausen* (holotype, MBML; isotypes, GUA, MO, RB n.v.). Figure 1.

A congeneribus indumento cinnamomeo-tomentello ramulorum, petiolorum et venarum recedit; a *Williamodendro quadrilocellato* pedicellis glabris et a *W. glaucophyllo* foliis apice obtusis vel emarginatis differt.

Trees, to 20 m tall. Twigs terete, older ones with conspicuous scars of fallen leaves, cinnamon brown-tomentellous. Terminal bud cinnamon brown-tomentellous. Leaves alternate or somewhat clustered toward the tips of the branches, chartaceous, 12–25 × 5–9 cm, obovate, the base acute, the tip obtuse or slightly emarginate, lateral veins 9–13 on each side, immersed on upper surface but, together with midrib and tertiary venation, raised on lower surface, the upper surface somewhat shiny, glabrous or with traces of tomentellous pubescence along midrib and lateral veins, especially near the base, the lower surface with tomentellous midrib and lateral veins, the indument becoming sparser on tertiary veins and lamina surface, lower surface with ashy color. Petioles of mature leaves 2–5 cm long, flattened on upper surface, with similar indument as twigs. Inflorescences axillary, to 5 cm long, paniculate, brown-tomentellous, especially near the base, the flowers arranged singly or in cymes along the lateral branchlets. Flowers subtended by one pubescent, lanceolate bract ca. 0.7 mm long, and two lanceolate bracteoles, each ca. 0.4 mm long. Pedicels to 1.4 mm long, glabrous or nearly so. Flowers glabrous, green, bowl-shaped, 2 mm wide and 1 mm high. Tepals 6, glabrous, incurved, or somewhat erect, broadly ovate, ca. 1 mm long, the outer three slightly longer than the inner three. Stamens 3, 4-celled, opposite the outer tepals, the cells apical on the flat tip of the anther. Staminodia 3, densely pubescent, opposite the inner tepals. Ovary glabrous, depressed globose, style short; gynoecium in young flower 0.7 mm long. Receptacle pubescent inside. Fruit a drupe, ± globose, ca. 3 × 3 cm, the minute tepals persistent at the base, but not forming a distinct cupule

Common names: Canela limão, Tapinhoã.

Paratypes. BRAZIL. Espírito Santo: Santa Teresa, Santa Lucia, *Boudet Fernandes et al. 2399* (st) (GUA, MBML, MO); same locality, *Boudet Fernandes et al. 2401* (juv.) (GUA, MBML); *Boudet Fernandes 2600* (fr) (MBML, MO); *Boudet Fernandes 2601* (fr) (MBML, MO).

The genus *Williamodendron* was recently described by Kubitzki & Richter (1987), who included in it two species previously placed in *Mezilaurus* (van der Werff, 1987). Kubitzki & Richter based their new genus on the combination of the flowers with three 4-celled stamens and details of bark and secondary xylem anatomy. The position of its anther cells, on the flat, apical portion of the anther, is highly unusual in neotropical Lauraceae; it also occurs in the recently described *Povedadaphne* (Burger, 1988) from Costa Rica. However, *Povedadaphne* has nine fertile stamens and does not have the typical aspect of *Williamodendron* (obovate, frequently clustered leaves with long petioles); its relationships are not clear.

Kubitzki & Richter (1987) considered *Mezilaurus* (including *Clinostemon*) to be the closest relative of *Williamodendron*. With this, I agree; in my opinion, the differences in floral and wood/bark anatomical characters warrant the recognition of *Williamodendron* as a distinct genus, closely related to *Mezilaurus*. Fruiting material of *Williamodendron* was not known to Kubitzki & Richter. The species here described has a globose fruit subtended by the small, persistent tepals, which form a small collar at the base of the fruit.

A fruiting specimen recently collected near Iqui-

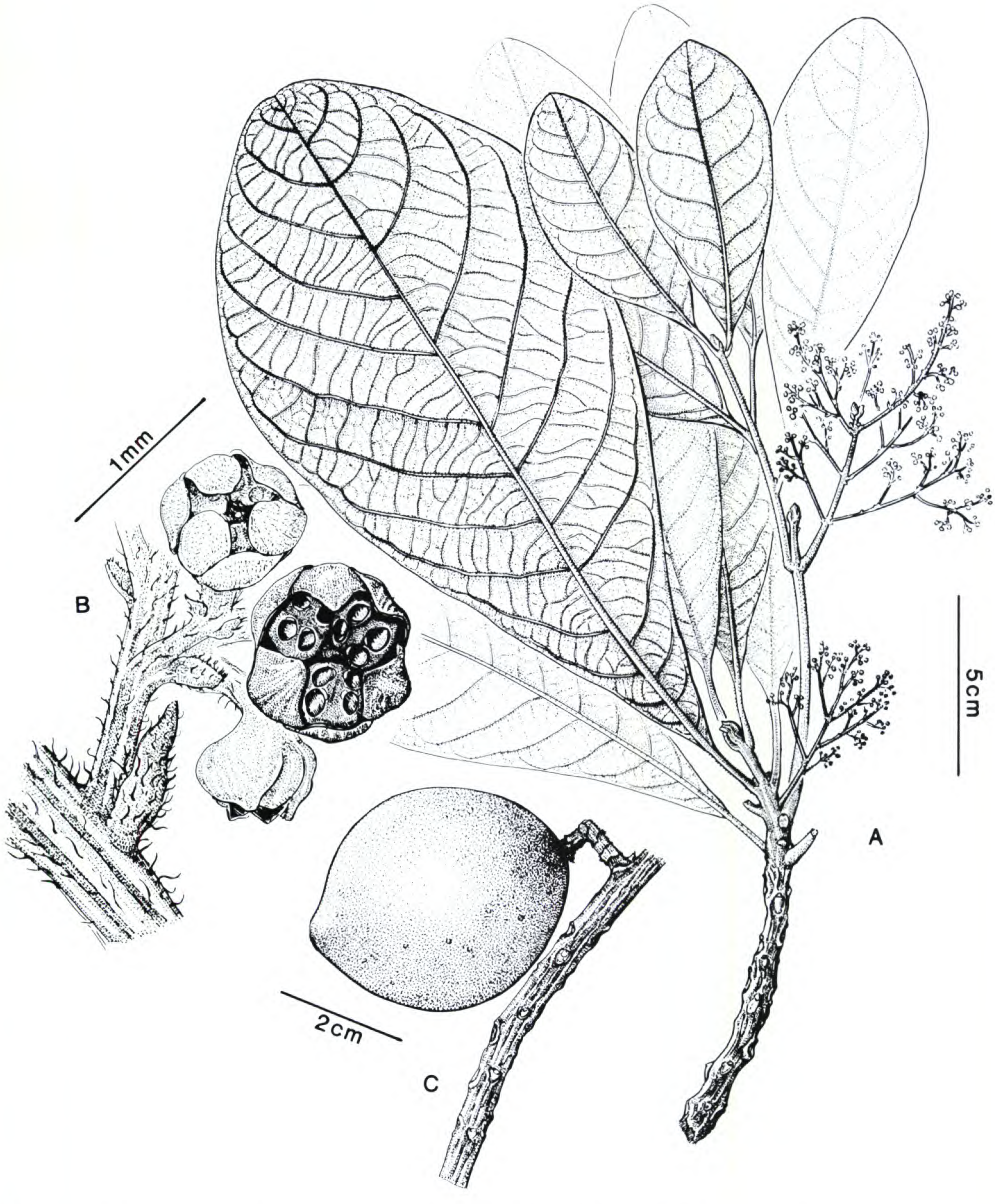

Figure 1. *Williamodendron cinnamomeum* van der Werff. —A. Habit. —B. Flower. —C. Fruit.

tos, Peru, is similar; the fruit is ellipsoid, 3 × 1.5 cm, and has a narrow collar, formed by persistent tepals, at its base (*van der Werff 10227* MO). This species has been recollected with flowers and has the same floral structure as *Mezilaurus mahuba* (Samp.) van der Werff. In the specimen from Espírito Santo the individual tepals at the base of the fruit are still recognizable, but in the specimen from Iquitos they are not. The latter specimen has dried staminodes (three large ones, sometimes alternating with three small ones) near the margin of the collar. Cupule shape of *Williamodendron* agrees very well

with that of *Mezilaurus* and suggests a close relationship between these genera, as does the shared common name for the *Williamodendron* and *Mezilaurus* species in southern Brazil (Tapinhoã). *Williamodendron cinnamomeum* is only known from Santa Teresa, Espírito Santo. Of the five collections, only one was flowering, and the inflorescence was, in comparison with the other two species of *Williamodendron*, very short. The MBML holotype has a 5-cm-long inflorescence attached to the twig, and the MO isotype has a detached inflorescence, also 5 cm long. I do not attribute much significance to the small inflorescences and expect that additional collections will have larger inflorescences. The juvenile collection was taken from a 1-m plant and differs from the mature trees in the following characters: leaves narrowly obovate (25–30 × 6–7 cm) and membranaceous, and lateral veins 15–20.

With this new species, *Williamodendron* includes three species, which can be separated as follows:

1a. Pedicels rufous tomentellous; this contrasting with the glabrous flowers ... *W. quadrilocellatum*
1b. Pedicels glabrous or with a few hairs near the base; flowers glabrous 2
  2a. Petioles minutely gray-puberulous; laminae below with scattered, appressed hairs, these less than 0.1 mm long; leaf tip acute ... . *W. glaucophyllum*
  2b. Petioles brown-tomentellous; laminae below with erect, curled hairs, these ca. 0.2 mm long; leaf tip obtuse to emarginate .... *W. cinnamomeum*

The distribution of these three species is as follows: *Williamodendron glaucophyllum* is restricted to Costa Rica, *W. quadrilocellatum* is known from northern Colombia and the surroundings of Manaus, Brazil, and *W. cinnamomeum* occurs only in the Atlantic rainforests of southern Brazil. This is the first record of this genus from southern Brazil. It is likely that further collecting will result in an increasing number of species. Sterile collections from Panama, Colombia, and Peru represent four additional species. Generic identifications of nonflowering specimens are difficult. A fruiting collection from Iquitos, first thought to represent an undescribed *Williamodendron* species (based on its large, obovate, clustered leaves with long petioles), turned out to be an undescribed species of *Mezilaurus*. Unfortunately, the small, greenish flowers make finding more material difficult.

I thank the curators of GUA and MBML for the gifts and loans of Lauraceae.

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Rorippa beckii (Brassicaceae), a New Species from Bolivia

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Rorippa Scopoli is a well-defined genus of about 80 species distributed on all continents except Antarctica. Nearly 25 species are indigenous to Europe and Asia, 23 to North America, 12 to Africa, 11 to South America, and the remainder to Australia, New Zealand, New Guinea, and Polynesia (Al-Shehbaz, 1988). Many authors have treated *Rorippa* and *Nasturtium* R. Brown as distinct genera. As shown by Al-Shehbaz & Rollins (1988), however, all of the alleged differences between the two genera show no consistent pattern if the complex is examined critically on a worldwide basis. The South American species of *Rorippa* are distributed primarily along the Andes, where they grow in wet habitats at altitudes of up to 4,000 m.

Rorippa beckii Al-Shehbaz, sp. nov. TYPE: Bolivia. Depto. La Paz: Prov. Ingavi, [Puerto] Guaqi, 3,810 m, en la orilla de lago Titicaca, [16°35′S, 68°51′W], 27 Apr. 1989, *S. G. Beck, E. Gómez & Z. Rúgolo 18139* (holotype, LPB; isotype, MO). Figure 1.

Herba perennis glabra, a basi ramosa, 5–10 cm alta; folia basales petiolata, pinnatisecta, subcarnosa, lobis lateralibus 3- vel 6-jugis, oblongis vel ovatis, sinuatis vel dentatis; racemi ad apicem bracteati, bracteae pinnatisectae; sepala erecta oblonga, 1–1.1 mm longa; petala alba, spathulata, 1–1.3 mm longa; pedicellae fructiferae arcuatae, recurvati, 3–4 mm longae; siliquae oblongae, obtusae, teretae, 4–7 mm longae, 2–2.5 mm latae; styli obsoleti; semina late ovata vel suborbiculata, compressa, biseriata, colliculata, 0.8–1 mm longa.

Perennial herbs, glabrous throughout, rooting from the lowermost nodes. Stems branched from the base, subdecumbent, 5–10 cm tall. Basal leaves petiolate, pinnatisect, somewhat fleshy, 1.5–3.5 cm long; lateral lobes in 3–6 pairs, oblong to ovate, sinuate to irregularly dentate or subentire, 3–5 mm long, 2–3 mm wide, progressively increasing in size toward leaf apex, the uppermost pair slightly smaller than the terminal lobe; petioles glabrous, slightly expanded at base, 5–10 mm long. Cauline leaves similar to basal but gradually decreasing in size upward and often with fewer lateral lobes. Inflorescences corymbose racemes, elongated considerably in fruit, bracteate throughout; bracts finely pinnatisect, with 2 or 3 pairs of lateral lobes, the petioles longer than pedicels. Sepals erect, ovate, glabrous, caducous, pale purple, scarious at margin, nonsaccate at base, 1–1.1 mm long. Petals spatulate, white, entire, 1–1.3 mm long, 0.3–0.5 mm wide. Filaments erect, white, 1–1.2 mm long; anthers ovate, 0.15–0.2 mm long. Lateral nectar glands minute, median glands absent. Fruiting pedicels glabrous, strongly recurved, arcuate, 3–4 mm long. Fruits oblong, terete, obtuse at both ends, 4–7 mm long, 2–2.5 mm wide; septum complete; replum twisted after fruit dehiscence; style obsolete; stigma entire. Seeds broadly ovate to suborbicular, compressed, yellowish brown, finely colliculate, biseriately arranged in each locule, 0.8–1 mm long; cotyledons accumbent.

Rorippa beckii, which is named after Stephan G. Beck, is readily distinguished from all other New World members of *Rorippa* in having bracteate inflorescences, minute white flowers, obsolete styles, and strongly recurved fruiting pedicels. It is somewhat related to *R. nana* (Schlecht.) Macbride and *R. austroamericana* Martínez-Laborde, which it resembles in habit, leaves, flowers, and seed morphology. However, the last two have ebracteate inflorescences, conspicuous styles, and straight, divaricate fruiting pedicels. They were placed by Martínez-Laborde (1983, 1985) in the independent sect. *Kardamoglyphos* (Schlecht.) Martínez-Laborde. It is doubtful, however, that the present sectional classification of the genus is practical.

The presence of bracteate inflorescences in *Rorippa* is very rare and has been reported by Stuckey (1972) and Jonsell (1973) in the eastern Asiatic (China, Japan, and adjacent U.S.S.R.) *R. cantoniensis* (Lour.) Ohwi, which they recognized as *R. microsperma* (DC.) L. H. Bailey. It has also been reported by Jonsell (1974) in the widespread, tropical African *R. cryptantha* (Hochst. ex A. Rich.) Robyns & Boutique and in the Madagascan *R. millefolia* (Baker) Jonsell. Bracteate inflorescences are not known elsewhere in the genus, and they probably evolved independently in *Rorippa* in Asia, Africa, and South America. *Rorippa beckii* is very distinct from these Old World taxa and is readily distinguished by its strongly recurved pedicels 3–4 mm long, white flowers, minute anthers to 0.2 mm long, obsolete styles, and glabrous leaves. In contrast, the

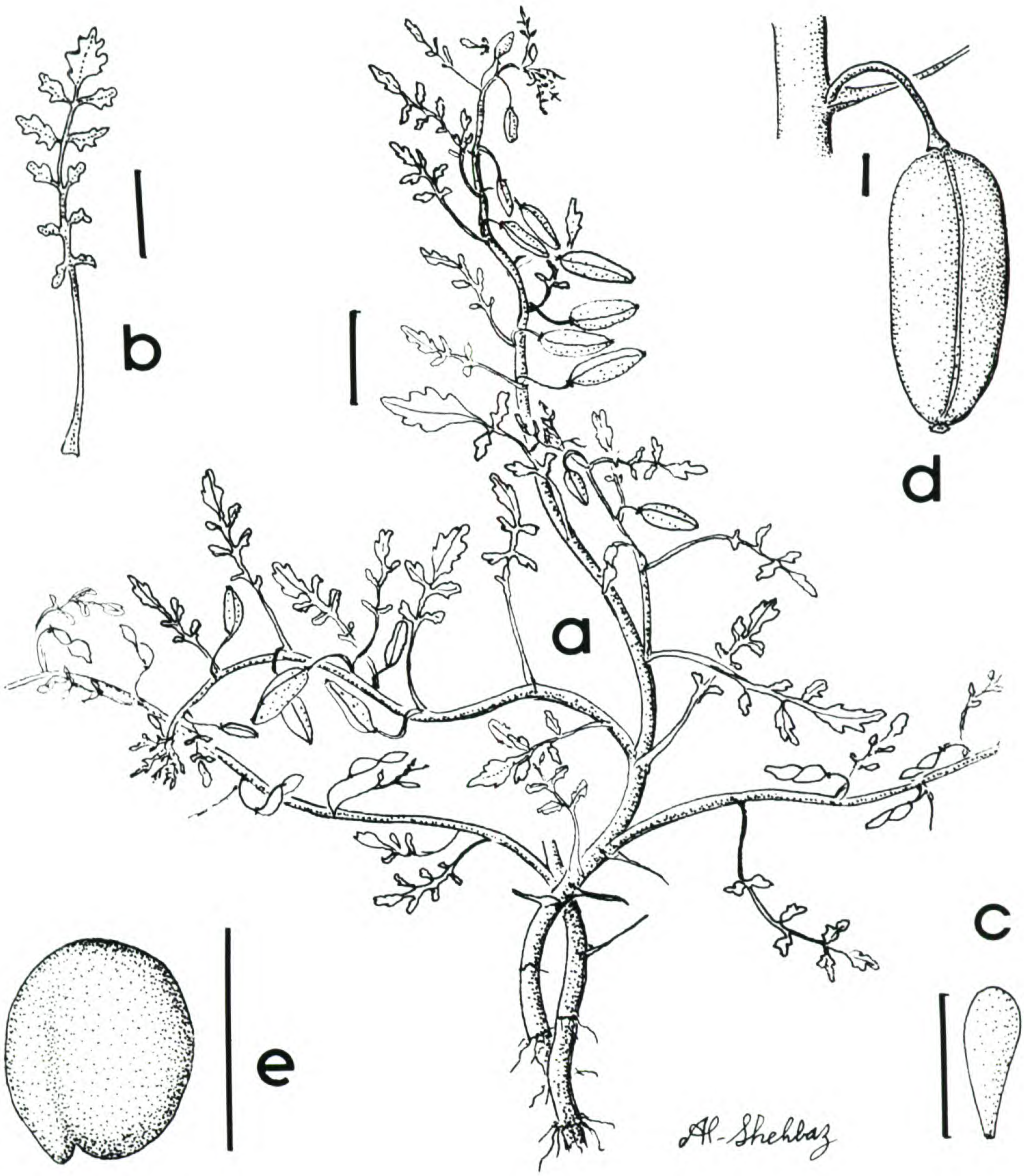

Figure 1. *Rorippa beckii*. —a. Habit. —b. Basal leaf. —c. Petal. —d. Fruit and fruiting pedicel. —e. Seed. Scales a, b = 1 cm; c–e = 1 mm. Drawn from the isotype at MO.

other species mentioned above have erect to ascending pedicels 1–2 mm long, yellow flowers, larger anthers 0.5–0.7 mm long, distinct styles, and almost always pubescent leaves.

I am grateful to James Solomon for his review of the manuscript.

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Chlorospatha kressii (Araceae), a New Compound-leaved Species from Chocó Department, Colombia

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The Andean-centered aroid genus *Chlorospatha*, belonging to the tribe Caladieae of the subfamily Colocasioideae, was regarded until a decade ago as monotypic, consisting only of *C. kolbii* Engl. (an enigmatic compound-leaved species still known only from a few century-old illustrations and a single, fragmentary herbarium specimen). In 1981, Madison redefined the genus to include the four species previously comprising *Caladiopsis*, which differed from *Chlorospatha* only in having simple rather than compound leaves. Since that time many new species have been described from Colombia, Ecuador, and Peru, bringing the total for the genus to 15 by 1986. Grayum (1986) predicted that many more species remained to be discovered and that, judging from intriguing but sterile herbarium specimens, the Chocó region of Colombia would be a rich source for such novelties.

The present paper describes a distinctive new *Chlorospatha*, not previously represented by sterile material, from Chocó Department.

Chlorospatha kressii Grayum, sp. nov. TYPE: Colombia. Chocó: ca. 10–15 km S of Quibdó on road to Istmina (Panamerican Hwy.), and 8–10 km E on road to petroleum exploration camp, ca. 90 m, 5°35′N, 76°37′W, 9 July 1986, *Grayum et al. 7643* (holotype, COL; isotypes, MO, CHOCO). Figures 1, 2.

Planta terrestris, rhizomatosa; rhizoma horizontale vel apice erectum usque 2.5 cm latum in statu vivo; petiolus 25.1–30.5 cm longus; lamina membranacea 11–13(–14)-pedatisecta foliolis plerumque anguste oblanceolatis versus basim angustatis apice sensim longiacuminatis utrinque fere glabris margine aliquantum undulatis; foliola nervis lateralibus nervum collectivum marginem bene distantem conjunctis; foliolum centrale (9.8–)21.0–22.1 cm longum (0.8–) 2.1–3.2 cm latum foliola lateralia quintum utroque latere 4.9–12.5 cm longa 1.0–2.2 cm lata; inflorescentiae ad usque 3, pedunculis gracilibus 8.0–13.7 cm longis; spatha 5.3–6.2 cm longa ca. 8 mm lata non constricta intus atroviolacea; spadix 3.90–4.15 cm longus stipite ca. 5–8 mm longo spathae adnato parte feminea 1.70–2.15 cm longa parte mascula sterili 2.5–4.0 mm longa parte mascula fertili aliquantum clavata 1.3–1.6 cm longa 2.6–2.8 mm lata; flores feminei atque masculi cremei; flores feminei 1.3–1.5 mm alti 2.0–2.4 mm lati; flores masculi steriles aliquantum fungiformes vel incudiformes 0.7–1.1 mm alti 0.6–0.8 mm lati; flores masculi fertiles 0.8–1.9 mm lati stamine solitario vel 2–3(–4?) connatis; fructus ignoti.

Rhizomatous, terrestrial herb, the rhizome horizontal to apically erect, 0.8–1.0 cm wide when dry, to perhaps 2.5 cm thick when fresh, clothed apically with persistent reddish brown cataphyll fibers. Cataphylls 3.1–11.3 cm long, 3–6 mm wide, broadly to narrowly lanceolate. Petiole terete, obscurely dark-mottled, 25.1–30.5 cm long, sheathed basally for 1.7–11.8 cm. Lamina membranous, weakly bicolored, matte above, weakly glossy below, pedately compound with 11–13(–14) leaflets, the latter mostly narrowly oblanceolate (broadest above the middle) or (especially the outer ones) narrowly elliptical to lanceolate, narrowed at the base and broadly attached, gradually long-acuminate apically, virtually glabrous on both sides (minutely pubescent along major veins below), the margins virtually entire but somewhat undulate; midrib and primary lateral veins sunken above, convex below, the lateral veins united in a conspicuous collective vein running well inside the margin; tertiary veins visible and slightly darker below; central leaflet (9.8–)21.0–22.1 cm long, (0.8–)2.1–3.2 cm wide; first (innermost) lateral leaflets generally slightly wider; fifth (outermost or next outermost) lateral leaflets 4.9–12.5 cm long, 1.0–2.2 cm wide. Inflorescences to at least 3 per axil, the peduncles very slender, terete, 8.8–13.7 cm long. Spathe 5.3–6.2 cm long, ca. 8 mm wide, not constricted, uniformly green externally, deep violet within (pale yellow-green in apical fourth), with conspicuous reticulate venation when dry. Spadix 3.90–4.15 cm long, on a stipe ca. 5–8 mm long, adnate to spathe in basal ca. 1 cm (i.e., only along stipe and perhaps very base of pistillate region), the axis violet, ca. 1 mm wide; pistillate portion of spadix ca. 1.70–2.15 cm long; sterile staminate portion ca. 2.5–4.0 mm long, the fertile staminate portion somewhat clavate, 1.3–1.6 cm long, 2.6–2.8 mm wide. Flowers of both sexes cream-colored; pistillate flowers broadly conical, 1.3–1.5 mm high, 2.0–2.4 mm wide; sterile staminate flowers somewhat fungoid

Figures 1, 2. *Chlorospatha kressii* (*Grayum et al. 7643*). —1. Entire plant, showing rhizome, cataphylls and slender peduncles. —2. Example of a large, fully pedate leaf, one half folded over the other; the central leaflet is at the far right.

to anvil-shaped, 0.7–1.1 mm high, 0.6–0.8 mm wide; fertile staminate flowers 0.8–1.9 mm wide, the stamen solitary or 2–3(–4?) united in a synandrium. Fruits unknown.

Distribution. Chlorospatha kressii is known only from the type locality, a small enclave of relatively intact, lowland primary forest southeast of Quibdó in Chocó Department, Colombia. At the time of the original collection in 1986, primary forest throughout this region was being actively felled, the most recent damage extending to within a few hundred meters of the only known population of *C. kressii*. Because this site was apparently not protected in any way, it is almost certain that this population has vanished during the last four years. The plants grew "on slopes near (a) stream in deep primary forest," and should be sought in similar habitats in more pristine parts of the Chocó region.

Live specimens of *Chlorospatha kressii* propagated from cuttings collected at the type locality were still surviving as of February 1989 at The Marie Selby Botanical Gardens (SEL).

The previously known compound-leaved species of *Chlorospatha* are discussed and keyed in Grayum (1986). *Chlorospatha kressii* differs from all of these in its 11–13-pedate leaves. Only two other species, *C. croatiana* Grayum (Colombian specimens) and *C. kolbii*, have been reported to have pedately compound leaves with as many as seven to nine leaflets. *Chlorospatha croatiana* differs markedly from the new species in its generally larger size with much longer petioles (50–70 cm), much broader leaflets (central ones 9–15 cm wide), longer peduncles (13–33 cm), and larger inflorescences.

Chlorospatha kolbii, according to the description in Engler & Krause (1920), differs from *C. kressii* in having much shorter and hence proportionately broader leaflets (central ones 8–10 cm long). It might be argued that the specimens of *C. kolbii* cultivated in Europe during the previous century were poorly grown and depauperate, hence with smaller leaves and fewer leaflets than wild-grown plants. However, the inflorescences of *C. kolbii* are described as larger than those of *C. kressii* in virtually every aspect: spathe (7–8 cm long), entire

spadix (ca. 6 cm long), stipe (1.5 cm long), adnate portion of spadix (2 cm long), sterile staminate portion of spadix (1 cm long), and fertile staminate portion of spadix (3 cm long).

The only existing herbarium specimen purported to represent original material of *Chlorospatha kolbii*, *Hort. W. Bull s.n.*, 20 Sept. 1878 (K) from "South America," was examined in connection with the present investigation. This is a sterile specimen consisting of a single, 9-pedate leaf, with the central leaflet 10.5 cm long. These features accord well with the description of *C. kolbii* and reinforce the notion that *C. kressii* is a different species. Furthermore, the adaxial laminar epidermis of *Bull s.n.*, viewed under low magnification, exhibits a very distinctive whitish-alveolate appearance not observed in available dried material of *Chlorospatha kressii*.

Several distinct *Chlorospatha* species are now known that conform in a general way with the description of *C. kolbii* (e.g., *C. croatiana*, *C. gentryi* Grayum, *C. kressii*), and other such species represented only by sterile material are yet to be described. Although it may be annoying that the real *C. kolbii* remains at large, the name must not be applied arbitrarily and there is every reason to insist on a reasonable correspondence with the protologue.

The new species is dedicated to W. John Kress of the Smithsonian Institution, an observant specialist in large monocots, who was the first to encounter these plants in the field.

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Herpetacanthus stenophyllus (Acanthaceae), a New Species from Costa Rica

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With the exception of some collections made a century ago by Henri Pittier and Adolfo Tonduz, the entire Caribbean slope of the Cordillera de Talamanca of Costa Rica has remained relatively unknown botanically. The species described below is from a large collection made recently in this area.

Herpetacanthus stenophyllus Gómez-L. & Grayum, sp. nov. TYPE: Costa Rica. Limón: Reserva Biológica Hitoy-Cerere, siguiendo el Sendero Espavel hasta la fila, Cordillera de Talamanca, 9°39′15″N, 83°01′20″W, 695 m, *Herrera & Chacón 2404* (holotype, CR; isotypes, F, MO, USJ). Figure 1.

Species insignis folia lanceolata longiora atque angustissima, margine undulata, a species nobis notis bene distincta. Fruticulus 0.75–1.5 m altus, laxus. Caules ramulique graciles, virides, ad nodis incrassati, pilis adpressis serialibus vestiti, cystolithis conspicuis numerosissimis. Foliae oppositae; petiolis 4–12 mm longis, supra adpressi-pilosis. Lamina linearo-lanceolata, 8–19 cm longa, 4–10 mm lata, circa 9–12 nervis secundariis arcuatis, apice acuminata, base attenuata, glabra, cystolithis copiosis, margine integra undulata. Inflorescentiae spicatae axillare vel terminale, 2–7-florae, 2–4 cm longae, 1–3.5 cm latae. Bractea 1, ovata, 11–15 mm longa, 5–8 mm lata, trinervata, apice acuta, utrinque pallide viridia, inaequalis-basae, plerumque sessilis. Bracteolae 2, lanceolatae, 8 mm longae, circa 1 mm latae. Sepala 5, inaequalia, 5–8 mm longa, subulata. Corolla bilabiata, 16 mm longa (tubus 6 mm longus, 1.5 mm latus), ore 3 mm lata, alboviridis, ad lobulis purpurini-lineolata vel -maculata; labio superiore 6–6.5 mm longo, 3.5 mm lato, apice minute bidentato; labio inferiore trilobulato, lobulis 1.5 mm longis. Stamina 4, didynama, inclusa; stamina longiora antheris bilocularibus, loculis superpositis, 1 mm longis; stamina breviora antheris unilocularibus, loculis 0.8 mm longis; filamenta plana pilis glanduliferis munita. Ovarium glabrum. Stylus 14 mm longus, inclusus, pilosus; stigma simplex capitatum. Fructus claviformis, 11 mm longus, glabrus, apice acutus, retinacula acuta vel rotundata. Semina 4 irregulariter elliptica, circa 2 mm diametro, castanea, complanata.

Open subshrub 0.75–1.5 m tall. Stems and branches slender, green, thickened at the nodes, appressed-pubescent in lines, with conspicuous and very numerous cystoliths. Leaves opposite; petioles 4–12 mm long, appressed-pilose above. Blade linear-lanceolate, 8–19 cm long, 4–10 mm wide, with 9–12 arcuate secondary veins, apically acuminate, basally attenuate, glabrous but with abundant cystoliths on both surfaces, the margins entire, undulate. Inflorescence spicate, axillary (in the uppermost axils) and/or terminal, 2–7-flowered, 2–4 cm long, 1–3.5 cm wide. Bract 1, ovate, 11–15 mm long, 5–8 mm wide, trinerved, apically acute, pale green on both sides, basally asymmetrical, usually sessile. Bracteoles 2, lanceolate, 8 mm long, ca. 1 mm wide. Sepals 5, unequal, 5–8 mm long, subulate. Corolla

Figure 1. *Herpetacanthus stenophyllus* (*Hammel & Grayum 14312*).

bilabiate, 16 mm long (tube 6 mm long, 1.5 mm wide); throat 3 mm wide, whitish green, the lobes purple-lined or -spotted; upper lip 6–6.5 mm long, 3.5 mm wide, apically minutely bidentate; lower lip trilobulate, the lobes 1.5 mm long. Stamens 4, didynamous, included; anthers of the longer stamens 2-loculed with the locules superposed, 1 mm long; anthers of the shorter stamens 1-loculed, the locules 0.8 mm long; filaments flattened, glandular-pilose. Ovary glabrous. Style 14 mm long, included, pilose; stigma simple, capitate. Fruit claviform, 11 mm long, apically acute, the retinacula acute or rounded. Seeds 4, irregularly elliptical, ca. 2 mm diam., castaneous, compressed.

Additional specimens examined. COSTA RICA. LIMÓN: Cordillera de Talamanca, Valle de las Rosas, Miramar, afluentes del Río Moín, margen izquierda, 9°38′20″N, 83°00′30″W, 350 m, *Herrera & Chacón 2390* (CR, MO); Hitoy Cerere Reserve, SW of Valle La Estrella, along Río Cerere to ca. 1 km upstream from Quebrada Barrera, 9°40.5′N, 83°02′W, 90–200 m, *Grayum & Hammel 5778* (CR, MO); Hitoy Cerere Reserve and vicinity in Valle La Estrella S of Finca Concepción, from station to top of ridge Mirador or Los Jabillos, 9°42′N, 83°02′W, 140–500 m, *Hammel & Grayum 14312* (CR, DUKE, GRI, MO).

Herpetacanthus Nees is a small genus of about 10 species, mostly Brazilian. It is distinguished by its bilabiate corollas and didynamous stamens (the long pair 2-celled, with one of the cells superposed; the shorter pair 1-celled). Only one species, *Herpetacanthus panamensis* Leonard, has been known from Costa Rica and Panama (Durkee, 1978, 1986). This differs markedly from *H. stenophyllus* in its ovate to ovate-elliptic leaves 4–14 cm long and 2.5–6 cm wide, plain white corollas, glabrous stamen filaments, and pubescent capsules. *Herpetacanthus stenophyllus* is distinguished by its linear-lanceolate leaves, 8–19 cm long and only 4–10 mm wide, with undulate margins; it is further differentiated by having greenish white corollas with purple lines or spots, glandular-pubescent staminal filaments, and glabrous capsules. All of the remaining *Herpetacanthus* species described to date are accounted for in Nees von Esenbeck (1847) or Lindau (1904); none are reported as exhibiting the distinctive, narrowly elongate leaf shape of *H. stenophyllus*.

Herpetacanthus stenophyllus is presently known only from the mountainous region between the Río Estrella (Valle de La Estrella) and the Río Telire (Valle de Talamanca), from about 100 to 700 m. Here it may be locally abundant, growing in patches in slightly disturbed sites in primary forest. Although its extremely narrow leaves give *H. stenophyllus* the aspect of a rheophyte, it does not grow along streams.

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Hernandia lychnifera (Hernandiaceae), a New Species from Coastal Ecuador

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Hernandia, of the small, lauralean family Hernandiaceae, comprises approximately 25 species of mainly evergreen, forest trees. Although nominally pantropical, the genus is most diverse in the Indo-Pacific region; only a third of the species are neotropical, and half of these are restricted to the West Indies. The most recent revision of *Hernandia* (Kubitzki, 1969) recognized only two Mesoamerican species, *H. didymantha* J. D. Smith and *H. stenura* Standley. *Hernandia* was long known from South America by just one species, *H. guianensis* Aublet, largely confined to the Venezuela/Guiana region. The genus was first reported from Pacific South America in 1948 by Little, on the basis of a single Ecuadorian collection (*Holdridge & Little 6191*) made five years previously and identified as *Hernandia sonora* L. This remained the sole specimen known from the region to Kubitzki (1969), who provisionally included it with *H. stenura* under the subheading "Abweichende Exemplare."

Collections accumulated and/or studied since Kubitzki's (1969) revision have resulted in the description of *Hernandia hammelii* D'Arcy (1981) from Panama (perhaps a synonym of *H. didymantha*; see Burger, 1990) and the extension of the range of *H. guianensis* deeper into the Amazonian region. *Hernandia didymantha* can now be reported south to Chocó Department (*E. Forero et al. 1937*, MO; *L. Forero 497*, MO) and Esmeraldas Province (*Jávita & Epling 2036*, MO) in the Pacific lowlands of Colombia and Ecuador, respectively. The entity previously known only by *Holdridge & Little 6191* is now represented by several additional collections, confirming it to be a distinctive species new to science. This, the southernmost *Hernandia* in Pacific South America, is apparently a narrow endemic in grave and imminent danger of extinction. It is described below.

Hernandia lychnifera Grayum & Zamora, sp. nov. TYPE: Ecuador. Los Ríos: Estación Biológica Río Palenque, Km 56 Quevedo–Santo Domingo, 150–220 m, 00°35.5′S, 79°22′W, 9 Apr. 1989, flowers and mature fruit, *Zamora & Grayum 1549* (holotype, QCNE; isotypes, AAU, COL, CR, HBG, MO, QCA, SEL, US). Figures 1, 2.

Arbor ca. 15–35 metralis. Caules juniores puberuli. Petioli 10–19(–23.5) cm longi. Laminae foliorum adultorum haud peltatae, 13.4–25.8 cm longae, 11.8–22 cm latae, late ellipticae, ovatae, oblongae vel rotundae, apice rotundatae vel obtuse breviacuminatae, basi truncatae, rotundatae vel cordatae, subcoriaceae, supra glabrae, infra sparsim puberulae vel dense tomentulosae. Inflorescentia corymbosa composita. Cymulae triflorae quattuor bracteis involucralibus spathulatis 5.0–6.3 mm longis subtentae. Flores viridi-albi. Flores staminati trimeri, ca. 7.5–8.8 mm longi. Flores pistillati tetrameri, ca. 9.5–9.7 mm longi. Cupula sub anthesi ca. 3.5–4.0 mm longa, ovarium superans; cupula sub fructu pendula, accrescens, inflata, obturbinata, urceolata vel subglobosa, 4.5–7.2 cm longa, 4.4–8.6 cm lata, membranacea, translucens, viridi-alba. Fructus maturus ellipsoideus, ater, ca. 3.3–3.9 cm longus, 2.8 cm latus, longitudinaliter octocostatus, conspicue umbonatus.

Canopy tree, fertile individuals according to collectors' notes ca. 15–35 m tall, the trunk straight, cylindrical, to at least 35 cm dbh, with smooth, lightly fissured bark. Young stems minutely puberulent. Petioles 10–19 cm long (to at least 23.5 cm on juvenile plants), (0.61–)0.68–0.75× length of lamina (0.80–0.87 on juveniles), minutely puberulent. Laminae epeltate, those of juvenile plants broadly ovate, to ca. 29 cm long and nearly as wide, long-acuminate (to ca. 2.3 cm) apically, cordate (to ca. 2.5 cm) basally, relatively thin, the laminar surface glabrous on both sides. Canopy leaves of adult plants broadly elliptical, ovate or oblong to rotund, broadest at or below the middle, rounded to abruptly and obtusely short-acuminate (to ca. 1.0 cm) apically, truncate or rounded to cordate (with sinus to ca. 1.1 cm deep) basally, subcoriaceous, the surface glabrous above, sparsely puberulent to (more usually) densely and finely tomentulose below, subpalmately 5–7-veined from the base (with 5–6 principal veins per side), 13.4–25.8 cm long, 11.8–22+ cm wide, the width ranging from 0.78 to 0.95× the length on both juvenile and adult leaves.

Figures 1, 2. *Hernandia lychnifera* (*Zamora & Grayum 1549*). —1. Apex of canopy branch bearing mature cupule and inflorescences (with flowers at anthesis). —2. Mature cupules (upper row); ripe fruit (center, lower row), flanked by immature cupules. Scale bars = 10 cm.

Inflorescence a compound corymb, the cymules generally borne on (2°–)3°(–4°) peduncles; ultimate inflorescence branches, bracts, cupules (at anthesis), perianths, and styles all uniformly tomentulose. Primary axillary peduncles (1.5–)7.5–12.9(–14.6) cm long, the primary corymbs (3.1–)6.2–16.6 cm long, (3.5–)7.8–14.9 cm wide. Cymules regularly 3-flowered (2 male flowers with 1 female), subtended by 4 spathulate involucral bracts ca. 5.0–6.3 mm long. Flowers greenish white. Staminate flowers 3-merous, ca. 7.5–8.8 mm long, the tube 2.7–3.1 mm long; outer perianth lobes 4.7–4.9 mm long, the inner ones 4.5–4.6 mm long. Stamens ca. 3.7–4.0 mm long, the filaments and connective densely pubescent; anthers 1.5–1.6 mm long; staminodes 6–10, 0.6–1.0 mm long, variable in size and morphology within a single flower. Pistillate flowers 4-merous, ca. 9.5–9.7 mm long, the tubule comprising half the total length; outer and inner perianth members subequal. Staminodes 4, ca. 1.4 mm long. Cupule at anthesis ca. 3.5–4.0 mm long, 3.0–3.1 mm wide, narrowed at the base, fleshy, truncate apically or virtually so, surpassing the ovary, in fruit pendulous, accrescent, inflated, obturbinate or urceolate to subglobose, becoming 4.5–7.2 cm long and 4.4–8.6 (–10 according to Dodson & Gentry, 1978) cm wide, stipitate by 0.6–1.0 cm, membranous and translucent, pale green to greenish white, the orifice ca. 1.2–1.5 cm diam. Ripe fruit ellipsoid, black, substipitate, ca. 3.3–3.9 cm long and 2.8 (–4.0 according to Dodson & Gentry, 1978) cm wide, longitudinally 8-costate, conspicuously umbonate at the apex, the umbo 0.6–1.1 cm diam. Seed oblate to globose, whitish, ca. 2.2–2.4 cm diam.

Additional specimens examined. ECUADOR. LOS RÍOS: Río Palenque Science Center, 150–220 m, *Dodson 5232* (QCA, SEL, US), *6135* (MO, QCA), *Dodson et al. 7571* (MO, SEL), *Gentry 9877* (MO), *9939* (MO—2 sheets), *Gentry & Dodson 35731* (MO), *Schupp 53* (SEL); Hacienda Manfrei, 14 km W of Buena Fe, 2 km S of road, 100 m, *Gentry & Loor 30796* (MO, SEL). PICHINCHA: from 43 to 68 km along trail from Santo Domingo to Quinindé, *Holdridge & Little 6191* (US).

Hernandia lychnifera, on the basis of its epeltate, subacuminate leaves and connate female bracteoles, is most closely related to the nine species assigned by Kubitzki (1969) to his rather weakly defined "*ovigera*-Gruppe," which also includes *H. guianensis* and *H. stenura*. Little (1948) was mistaken in equating the original collection of *H. lychnifera* with the West Indian *Hernandia sonora*, a very different species with peltate leaves belonging to Kubitzki's "*peltata*-Gruppe." As previously noted, Kubitzki tentatively referred that specimen to *Her-*

nandia stenura. Dodson & Gentry (1978) also adopted the latter name in their Río Palenque flora, noting Little's error but making no reference to Kubitzki's work.

It was immediately evident to the present authors, on encountering fertile individuals of *Hernandia* in the Río Palenque reserve, that we were confronted with something other than *Hernandia stenura*. The type specimen of *H. stenura* (*Brenes 13655*, F) was collected in Costa Rica, where we are both resident, and this is a species we know quite well. More detailed investigation confirmed our suspicion that the Río Palenque entity was new to science.

The most probable cause for prior confusion of the Río Palenque *Hernandia* with *H. stenura* is the close resemblance of leaves of juvenile plants of the former to adult leaves of the latter. This consideration is especially significant inasmuch as several collections of *Hernandia lychnifera* are either from sterile juveniles or were concocted from leaves of juvenile plants combined with cupules and fruits picked up from the ground. Juvenile leaves of *H. lychnifera* and canopy leaves of *H. stenura* converge in being broadly ovate, subcordate at the base, and typically long-acuminate to caudate at the apex (whence the epithet *stenura*). Canopy leaves of *H. lychnifera* (Fig. 1), on the other hand, have relatively shorter petioles and are thicker in texture, more densely tomentulose below, noncordate (or less deeply cordate) basally, and nonacuminate (or at best obtusely short-acuminate) apically.

The most obvious differences between *Hernandia stenura* and *H. lychnifera* involve the cupules and fruits. Whereas the cupule in *H. stenura* remains tightly adherent to the fruit and never completely covers it, that of the new species (Fig. 2) is markedly accrescent, becoming inflated ("resembles *Physalis*," as noted on the label of *Holdridge & Little 6191*) and forming a distally aperturate chamber which completely encloses the fruit. At maturity, the black fruit sits free in the bottom of the greenish white, membranous, translucent cupule. The pendent cupules have the appearance of lanterns or lamps hanging from the tree (inspiring the specific epithet). Both the cupule and fruit of *Hernandia lychnifera* far exceed those of *H. stenura* in absolute size and are, in fact, the largest yet reported for the genus (although the dimensions given by Dodson & Gentry, 1978, appear somewhat exaggerated). Furthermore, fruits of *H. lychnifera* are conspicuously umbonate, whereas those of *H. stenura* lack umbos altogether. The latter species differs additionally from *H. lychnifera* in its usually glabrate leaves and less ramified, fewer-flowered inflorescences with larger (to over 1 cm) involucral bracts.

The character of accrescent, membranous, inflated cupules vs. thick, fleshy, adherent cupules, which so strikingly distinguishes *Hernandia lychnifera* from *H. stenura*, has not been employed or adequately investigated in the genus by previous workers (e.g., Kubitzki, 1969). Perhaps this is because the nature of the cupule may be difficult to interpret on dried specimens. Although both species (*Hernandia didymantha* and *H. stenura*) previously known to the present authors possess the adherent type of cupule, *H. lychnifera* is by no means unique in having inflated cupules. In fact, this seems to be the more usual condition in the genus, and some authors (e.g., Burger, 1990) apparently believe it to be universal. *Hernandia guianensis* appears to have inflated cupules, but differs from *H. lychnifera* in generally being a much smaller tree (5–10 m tall, according to collectors' notes), with smaller leaves, shorter petioles and smaller cupules and fruits. The adult leaves are glabrate below instead of finely tomentulose. More significantly, the fruits of *H. guianensis* possess no umbo, a consideration that also eliminates from contention the two remaining neotropical representatives of the "*ovigera*-Gruppe," *Hernandia catalpifolia* Britton & Harris, of Jamaica, and *H. cubensis* Griseb.

The West African *Hernandia beninensis* Welw. ex Henriq. appears to show the closest overall resemblance to *H. lychnifera*, sharing large, broad, subcordate leaves and large, prominently umbonate fruits. However, *H. beninensis* is described as having nearly glabrous foliage, as well as shorter petioles (to 8.5 cm) and somewhat smaller fruits (2–3 cm long) than *H. lychnifera*.

Hernandia lychnifera was described as "common, in mature forest" at the Río Palenque Science Center by Dodson & Gentry (1978), and this was still the case in 1989. The trees are conspicuous when in fruit, as we encountered them, with cupules hanging abundantly from the crowns and littering the ground below. Nonetheless, we failed to encounter this species at several other forested sites (Reserva Endesa, Tinalandia, Centinela ridge) in the same general area, visited during the same period. These latter sites are all at somewhat higher elevations (600–800 m), and we conclude that *H. lychnifera* is probably endemic to lowland forests below 500 m (perhaps even below 300 m) on Ecuador's Pacific slope. This zone is now largely deforested, with suitable habitat being practically nonexistent. The species has never been refound in the vicinity of Holdridge & Little's original (1943) collection (still the only record from outside Los Ríos Province), despite intensive local botanizing. Thus, the Río Palenque reserve may well harbor the only

remaining population of *Hernandia lychnifera* of any significant size, and one can only wonder whether there are enough individuals in the tiny (167 ha) sanctuary to ensure the continued survival of the species.

As indicated by Dodson & Gentry (1978), *Hernandia lychnifera* is known by the common name "pechuga" in the Río Palenque region. This translates literally as "breast," and is the usual Spanish term for the breast portion of dressed poultry. Local residents familiar with the tree were unable to explain the relevance of this appellation.

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A New Species of *Guadua*, *G. ciliata* (Poaceae: Bambusoideae: Bambuseae), from Venezuela and Brazil

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The genus *Guadua*, as recognized by Soderstrom & Londoño (1987), comprises ca. 30 species and is restricted to lowland areas of the New World. It is included in subtribe Guaduinae of the tribe Bambuseae by Soderstrom & Ellis (1987). Species of *Guadua* are typically large, erect, woody bamboos with thorns. The type species of the genus, *G. angustifolia* Kunth, is the largest bamboo of the New World and among the largest in the world. McClure (1973) enumerated the species but recognized the group as *Bambusa* subg. *Guadua* (Kunth) Hackel.

While writing an account of the genus for the *Flora of the Venezuelan Guayana*, it became apparent that a suite of collections from Venezuela and Brazil represents a new species in the genus.

Guadua ciliata Londoño & Davidse, sp. nov. TYPE: Venezuela. Territorio Federal Amazonas: Dpto. Atabapo, Cucurital de Caname, southern bank of the middle part of Caño Caname, 3°40′N, 67°22′W, ca. 100 m, edge of forest, with *Mauritia*, seasonally inundated and hummocky, 30 Apr.–1 May 1979, *G. Davidse, O. Huber & S. S. Tillet 16924* (holotype, MO; isotypes, INPA, K, SI, TULV, US, VEN). Figures 1, 2.

Bambusa lignosa, culmis 4–10 m altis, 0.8–2.0 cm diam., cylindricis, cavis, glabris vel pubescentibus, internodiis 20–30 cm longis. Rhizoma sympodiale, pachymorphum. Folia culmorum demum decidua, vagina laminam excedente; lamina triangularis, erecta, margine ciliata; vagina glabra, basi annularis incrassata indurataque. Ramificationes intravaginales, inermes, ramo uno dominante. Folia in complemento 7–11; lamina 12–27.5 cm longa, 1.9–4.9 cm lata, lineari-lanceolata, nervo principali luteolo, infra prominenti; petiolus longus, hirsutus; ligula interior 1.0–2.2 mm longa; vagina glabra vel pubescens, in juvenilibus setis oralibus distaliter crispis, mox deciduis. Synflorescentiae ramos terminantes, 3–7 coflorescentiae. Pseudospiculae sessiles, lineari-lanceolatae, bractea singula subtendente, prophyllo singulo, glumis fertilibus 1–3, flosculis 5–9 et anthoecii rudimento terminali praesente; lemma ovata, 23–27 nervata, supra glabra vel subglabra, infra strigosa, margine ciliata; palea dorso 2 carinis conspicue alatis ciliatisque praedita; lodiculae 3; stamina 6, filamentis filiformibus, liberis; ovarium fusiforme, glabrum, stylo singulo, piloso, stigmatibus tribus plumosis.

Woody, climbing bamboo, lacking thorns, only the lowest portion self-supporting, the distal portion cascading down from trees. *Rhizomes* sympodial, pachymorph. *Culms* 4–10 m long, 0.8–2.0 cm diam., green when young, turning yellowish at maturity, rather slender; *internodes* mostly 20–30 cm long, cylindrical, usually glabrous, sometimes densely puberulent or appressed pubescent, hollow, with thick walls 2–4 mm wide, subsolid in the lower part of the culm and branches; *nodes* with a horizontal nodal line and a nearly horizontal nodal ridge, the area between the nodal line and ridge densely puberulent, a dense band 2–3 mm wide of white, retrorsely appressed hairs below the nodal line; *bud* solitary, positioned close to the nodal line, not elevated, planoconvex, the shoulders of the prophyll ciliolate. *Culm leaves* coriaceous, tardily deciduous, pushed away by the developing axillary branches; *sheaths* 8–15 cm long, 3.5–6.0 cm wide, abaxially glabrescent, adaxially glabrous, tessellate in the upper portion, stramineous when old, indurate, strongly attached by a basal, dark, well-marked, thickened, persistent girdle, the margins ciliate with purplish and hyaline hairs; *auricles* mostly lacking, rarely to 2 mm long and fimbriate on the margin with setae 5–8 mm long; *inner ligule* a truncate, densely ciliolate membrane 0.4–2.2 mm long, abaxially densely strigillose; *outer ligule* lacking; *blades* 1.0–2.4 cm long, 0.5–1.0 cm wide, triangular, erect and appressed to the culm, mucronate, thinner than the sheath, abaxially glabrous and conspicuously many-nerved, adaxially densely strigose between the nerves with hyaline or purple hairs, the margin finely ciliolate, the mucro 2–3 mm long, the junction with the sheath slightly notched. *Branching* intravaginal, typically with one strongly dominant, erect to patent branch at the lower nodes, the middle and upper nodes with a dominant central branch and with 2 slender branches arising from lateral buds at proximal nodes of the central branch. *Foliage leaves* 7–11 per comple-

ment, ± horizontal to drooping; *sheaths* green when young, turning stramineous, abaxially glabrous, rarely sparsely hispid, shiny, strongly nerved, bearing oral setae at the summit, the margins ciliate; auricles usually absent, occasionally developed to 1–3 mm long and fimbriate; *oral setae* irregularly developed, 2–11 mm long, early deciduous, straight below, curled distally, yellowish to stramineous; *inner ligule* 1.0–2.2 mm long, slightly incurved, membranous, broadly obtuse to truncate, glabrous or puberulent and finely ciliolate; *outer ligule* a stramineous rim 0.3–1.0 mm long, dipping in the middle, glabrous; *pseudopetiole* 0.5–1.4 cm long, pulvinate, adaxially hispidulous, abaxially glabrous, sometimes with a patch of hairs above the pulvinus, the pulvinus shiny, glabrous and yellowish; *blades* (9–)12–25(–27.5) cm long, (1.2–)2–3.5(–4.3) cm wide, linear-lanceolate, to ovate-lanceolate in flag blades, olive green, apically acuminate, 15–23-nerved, marginally scabrous, adaxially glabrous, abaxially glabrous and tessellate, the midnerve prominent, yellowish. *Synflorescences* usually terminating leafy branches of all orders, iterauctant, consisting of 3–7 coflorescences, each with 1–3 multiflowered pseudospikelets, occasionally forming ± dense aggregations of up to 100 pseudospikelets on leafless axes, the main axes glabrescent. *Pseudospikelets* (3–)5–7(–11) cm long, 3–4(–5) mm wide, linear-lanceolate, sessile, olive green when young, stramineous when mature, covered with wax, all but the terminal one on each branch consisting of 1 subtending bract, 1 prophyll, 1–3 gemmiparous glumes, and 5–9 florets, the distal 2–4 florets progressively reduced, ending in a rudimentary floret, the terminal pseudospikelet lacking an immediately subtending bract and prophyll; *rachilla* segments 3.0–9.5 mm long, ciliolate on the rim, disarticulating just below its juncture with the lemma, densely puberulent on segments between the subtending bract and the gemmiparous glumes, varying to glabrescent on the segments between the lemmas; *subtending bracts* throughout the main axis with blades from fully developed and similar to small foliage blades varying to reduced apicules, generally gemmiparous, the blades deciduous; *prophyll* 3–13 mm long, abaxially puberulent, adaxially shiny and glabrous, rarely enclosing a bud, the keels and margins ciliate; *gemmiparous glumes* 5–16 mm long, 6–9 mm wide, ovate to ovate-lanceolate, 13–19-nerved, only the midnerve prominent distally, usually apiculate, sometimes with a small blade, marginally ciliolate, abaxially glabrous or appressed pubescent, adaxially tessellate and densely strigillose toward the apex; *lemmas* 1.4–2.3 cm long, 7–9 mm wide, ovate, rounded on the back, 23–27-nerved, completely embracing the palea and the rachilla segment, apiculate, shiny, marginally ciliate with purplish and hyaline hairs 0.4–0.9 mm long, abaxially with appressed hyaline hairs between the nerves or glabrescent, adaxially tessellate and densely strigillose in the upper ⅛, the apiculum 1–2 mm long; *palea* smaller than the lemma, 8–17 mm long, ca. 2 mm wide, 2-keeled, the keels abaxially prominently winged, 4–7-nerved between the keels, purplish ciliolate at the summit between the keels, the wings of the keels 0.7–0.9 mm wide distally, 1–2-nerved, puberulent on both surfaces in the upper ½–⅓, purplish ciliolate above the middle, the cilia finer and hyaline toward the base, the margins of the palea overlapping, 2-nerved, glabrous on the back, ciliolate in the upper half; *lodicules* 3, 5.1–7.2 mm long, 1.5–2 mm wide, 9–13-nerved, acute, ciliolate near the apex with minute purple cilia, the anterior pair slightly asymmetrical, fleshy thickened below, thinly membranous above, the posterior one symmetrical, slightly narrower and thinner than the anterior pair; *stamens* 6, the filaments filiform, free, the anthers 5.5–7.5 mm long, attached in the lower ⅛, yellowish purple when young then brown, sagittate basally and emarginate apically; *ovary* fusiform, glabrous; style 1, pilose; stigmas 3, yellowish to red-brown, plumose. *Fruit* a caryopsis, 8.5–10.0 mm long (including the style base), 2.5–2.6 mm wide, dark brown, the body glabrous, the embryo side convex, the hilum side somewhat flattened, the apical portion asymmetrically curved in side profile; *embryo* ⅛ as long as the caryopsis; *hilum* a prominent groove as long as the caryopsis body; *style base* 1.5–2.7 mm long, persistent, densely pilose.

Additional collections examined. VENEZUELA. TERRITORIO FEDERAL AMAZONAS: Dpto. Atabapo, Caño Caname, S bank near Mavacal, 3°41′N, 67°23′W, ca. 95 m, 29 Apr. 1979, *Davidse et al. 16871* (BRI, CAY, MO, US, VEN); upper portion of Caño Caname, 3°40′N, 67°13′W, ca. 100 m, 3 May 1979, *Davidse et al. 17114* (COL, L, MO, US, VEN); lower part of Caño Yagua, Chipital, 3°29′N, 66°41′W, ca. 120 m, 7 May 1979, *Davidse et al. 17318* (MO, US, VEN); Río Puruname, 30–35 km desde la boca, 3°24′N, 66°20′W, 100–150 m, 30 May 1982, *Huber & Tillett 6389* (MO, US); Dpto. Río Negro, 0–0.5 km NW of San Carlos de Río Negro along river, 1°55′N, 67°5′W, 120 m, 28 Nov. 1977,

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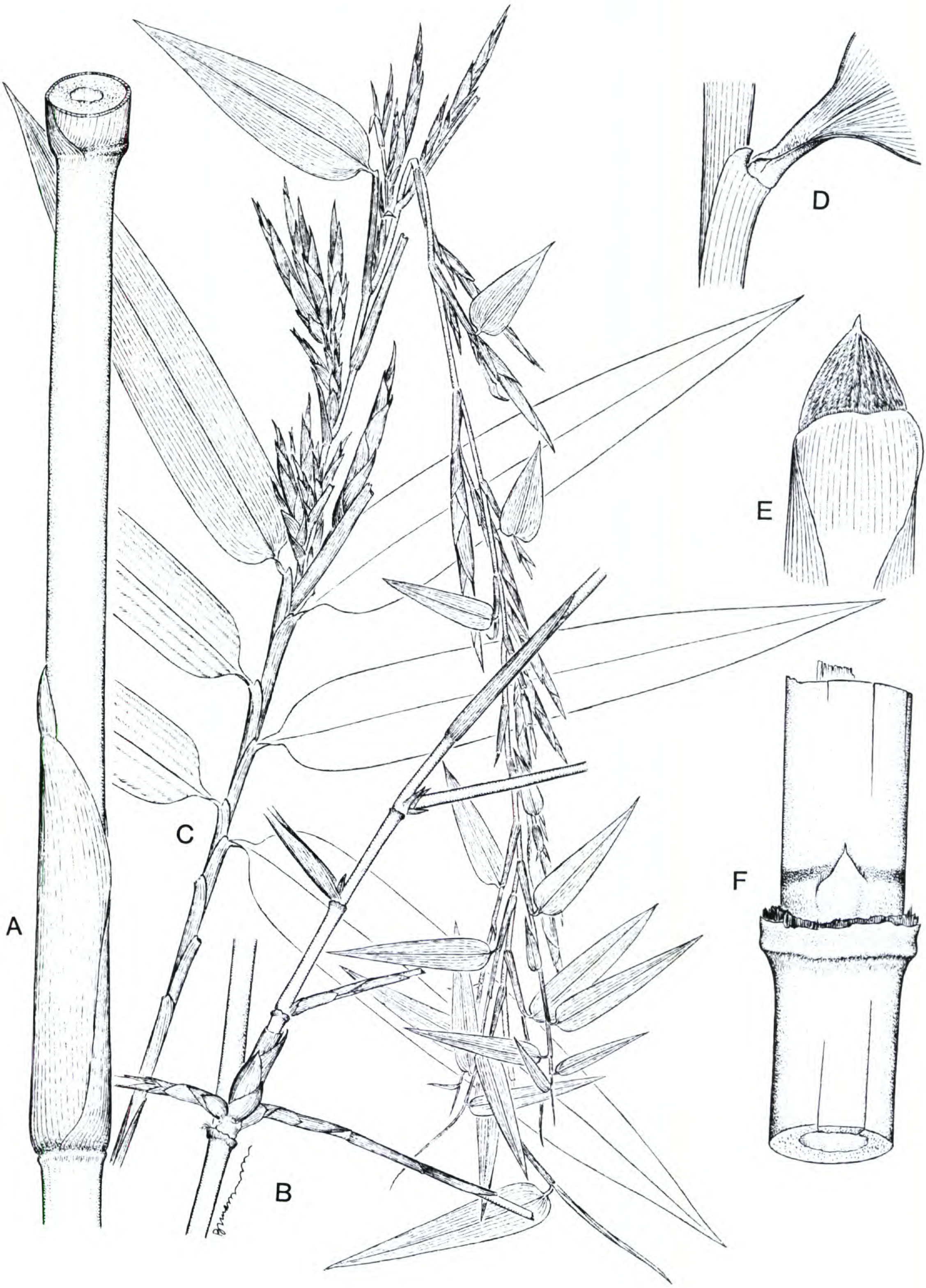
Figure 1. *Guadua ciliata* Londoño & Davidse. —A. Culm internode with an erect, appressed culm leaf; × 1. —B. Upper branch complement with one dominant central branch; × 1. —C. Flowering leafy branch showing the progressive reduction of the foliage leaves to the subtending bracts of the pseudospikelets; × 4. —D. Foliage leaf



showing ligules and pseudopetiole; × 5. —E. Culm leaf with glabrous sheath and adaxially densely strigose blade; × 2.5. —F. Solitary bud on culm node with persistent girdle of culm sheath and bands of hairs above and below the nodal line; × 3. (Based on the type collection *Davidse et al. 16924.*)

Liesner 3977 (ISC, MO, PRE, US, VEN); Solano, along the Brazo Casiquiare, 1°57′N, 66°57′W, 75 m, 26 June 1984, *Davidse & Miller 26665* (MO, US, VEN); 0–0.3 km NW of San Carlos and Río Negro, ca. 20 km S of confluence of Río Negro and Brazo Casiquiare, 1°56′N, 67°03′W, 120 m, 8 Apr. 1979, *Liesner 6373* (MO). BRAZIL. AMAZONAS: Rio Negro, Tapuruquara, 22 Jan. 1978, *Steward et al. 466* (MO); Rio Negro, Rio Tea, Bacurí, 12 Sep. 1979, *Kubitzki et al. 79-243* (MO, US); Rio Negro, Ilha Tamanquaré, near Santa Isabel do Rio Negro (Tapuruquara), 12 Sep. 1979, *Kubitzki et al. 79-251* (MO, US); Rio Negro, Tapuruquara, Igarapé Dará, 4 Sep. 1979, *Kubitzki et al. 79-135* (MO, NY, US); Rio Negro, lower Rio Curicuriary, 7 Sep. 1979, *Kubitzki et al. 79-177* (MO, NY, US); Rio Negro, proximo a Ponta Negra, Mar. 1976, *Coelho & Cosme Mota 762* (NY, US); Amazon River about 1 hr. above Manaus, 18 Aug. 1979, *Calderón et al. 2985* (NY); Rio Urubú, between intersection with Manaus–Caracaraí Road and Serra da Lua, 2 Aug. 1979, *Calderón et al. 2910* (MO, US); basin of Rio Negro, between Moreria and Rio Quinini, 10 Nov. 1971, *Prance et al. 16251* (NY, US); along the Rio Negro between Manaus and San Gabriel, between Paraná de Floresta and the mouth of the Rio Branco, 26 June 1979, *Alençar 56* (US); Secus Rio Negro, Brasiliae septentionalis, inter Barcellos et San Gabriel, Dec. 1851, *Spruce 1954* (GH, K, NY, P, US, W).

This new species is included in *Guadua* because it possesses the following combination of characters: similar branching pattern, pseudospikelets, fertile florets several, stamens 6, lodicules 3, stigmas 3, style 1 and pilose, palea keels winged, a band of hairs below and above the nodal line, and erect triangular culm blade contiguous or almost so with the culm sheath. Soderstrom & Londoño (1987) considered the last three characters, plus the presence of thorns on the culms and branches, to be apomorphies that define this genus. However, as pointed out by L. G. Clark (in litt.), culm blades contiguous or nearly so with the sheath is a character also found in *Rhipidocladum*, *Arthrostylidium*, and most species of *Chusquea*, so that this character is really not apomorphic for *Guadua*. In addition, as shown below, not all species of *Guadua* have thorns, and a few species of *Bambusa* possess them. Thus, only the winged palea keels and the band of hairs below the nodal line seem to be good apomorphic characters for *Guadua*.

At least two other described species of *Guadua*, *G. capitata* (Trin.) Munro and *G. glomerata* Munro, as well as several undescribed species, are also climbing with relatively slender culms. Most of these have thorns, but some, including *G. capitata*, lack them. Presently, some of these species are so incompletely known that it is difficult to make an assessment, but further studies may show some of the climbing species to form a distinct group.

Guadua ciliata appears to be most closely related to *G. latifolia* (Humb. & Bonpl.) Kunth and *G. glomerata*. The three species are very similar in the form of the culm and foliage leaves. *Guadua ciliata* is distinguished from *G. glomerata* by the hollow, smooth, and thornless (vs. solid, strigose, and slightly thorny) culms, the erect (vs. reflexed) pseudospikelets, and the ciliate (vs. glabrous) margins of the spikelet bracts. They are similar in the climbing habit and the form of the branch complements.

Guadua ciliata is distinguished from *G. latifolia* by the climbing (vs. erect) habit, the much thinner (0.8–2 cm vs. 3–7 cm diam.) culms, lack of thorns, the usual lack of prominent auricles and fimbria on the culm leaves, and the relatively narrower paleas with fewer veins and narrower wings on the keels. In *G. latifolia* the palea keel wings are widest below the middle, whereas in *G. ciliata* they are widest above the middle. *Guadua ciliata* is similar to *G. latifolia* in its usually glabrous culm sheaths and prominently ciliate spikelet bracts; the specific epithet is based on the latter character. The lower branches of *G. latifolia* are usually strongly thorny, although there seems to be a lot of variation in this feature.

Guadua ciliata was apparently first collected by Spruce in 1851 along the Rio Negro in Brazil under his number *1954*. Shortly afterwards, Munro (1868) misidentified *Spruce 1954* as *G. latifolia*, probably because of the general similarity of the spikelets, and especially because of the ciliate lemmas. As noted by McClure (1973), this mistake was repeated by Doell (1880) in *Flora Brasiliensis*. The illustration (tab. 49) of *G. latifolia* in *Flora Brasiliensis* was also based on *Spruce 1954*, but actually represents *G. ciliata*. In his notebook, Spruce named his collection *1954*, *G. fragilis*, a name cited as a nomen nudum in synonymy by Munro (1868) but never validly published.

We have studied an isotype and a photograph of the holotype of *Bambusa latifolia* Humb. & Bonpl. (Venezuela. Amazonas: Río Casiquiare, *Humboldt & Bonpland 1090* (isotype, P)), which is the basionym for *G. latifolia*. We consider the following collections to belong to this species: Venezuela. Territorio Federal Amazonas: Dpto. Río Negro, Neblina Base Camp on the Río Mawarinuma, 0°50′N, 66°10′W, elev. ca. 140 m, 17 July 1984, *Davidse & Miller 27454* (MO, VEN); same locality, 17 July 1984, *Davidse & Miller 27432* (BRI, COL, K, LE, MEXU, MO, P, PRE, TULV, US, VEN); 22 Feb. 1984, *Liesner 16183* (MO); 19 Feb. 1985, *Nee 30958* (MO, NY); upper Río Baria, ca. 0°55′N, 66°15′W, elev. 100 m, 2–3 July 1984, *Davidse & Miller 26893* (CANB, COL, F, INPA, ISC, K, L, LE, MEXU, MG, MO, NY, PRE, TULV, US,

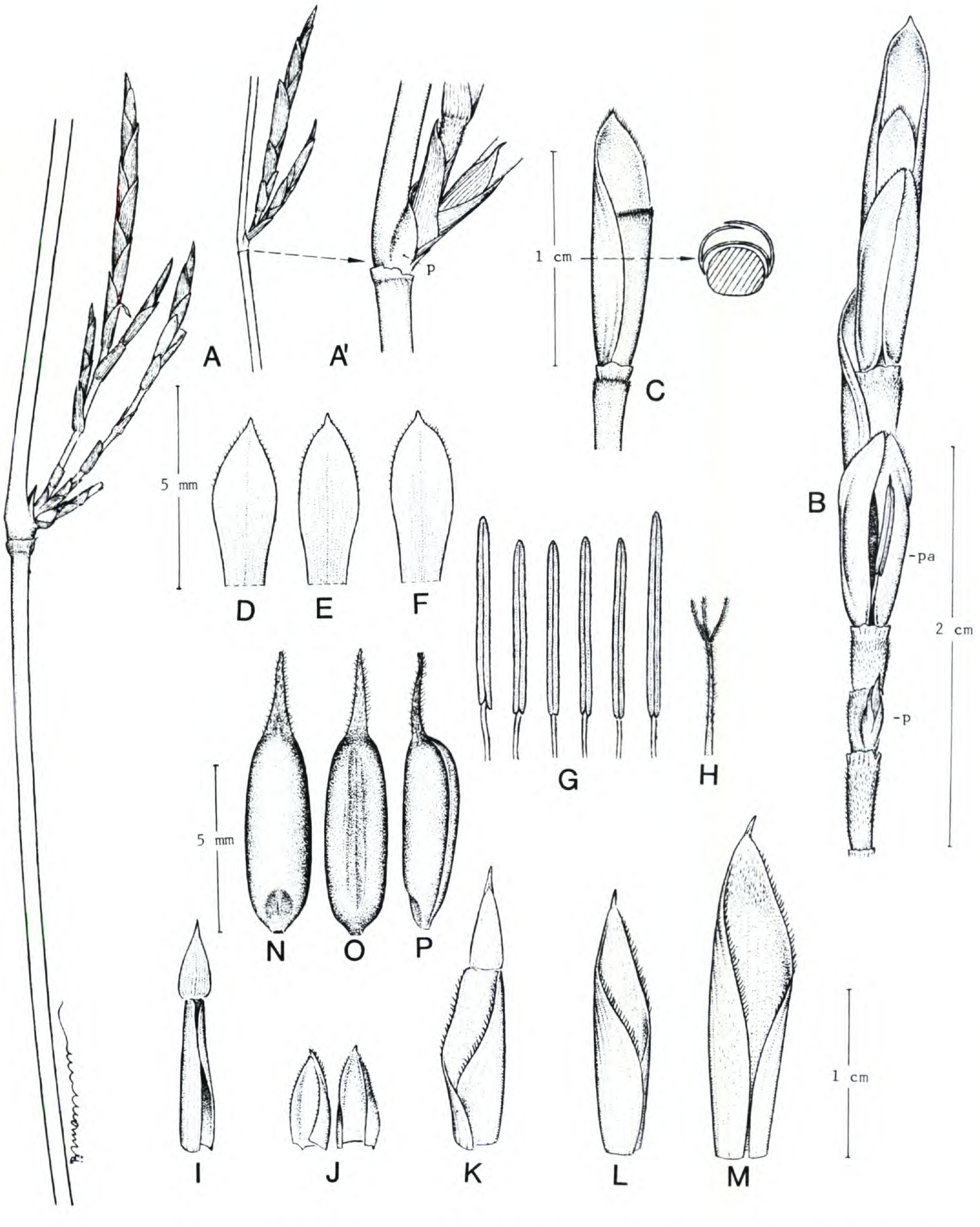


Figure 2. *Guadua ciliata* Londoño & Davidse. —A. Leafless flowering branches with 4 pseudospikelets (left) and 2 pseudospikelets (right); × 1. —A′. Enlargement of Figure A (right) with the subtending bract of the coflorescence removed (arrow), thus exposing the position of the prophyll (p); × 6. —B. Partial dissection of pseudospikelet with gemmiparous glumes and lemmas removed showing rachilla segments, prophyll enclosing a pseudospikelet bud (p), and palea enclosing a flower (pa). —C. Palea with winged keels attached to rachilla segments with the lemma removed; the arrow points to a diagrammatic cross-sectional view showing the clasping wings of the palea keels and the overlapping palea margins. —D. Anterior lodicule. —E. Posterior lodicule. —F. Anterior lodicule. —G. Androecium of 6 young stamens. —H. Gynoecium with glabrous ovary, pilose style, and 3 plumose stigmas. —I. Subtending bract with developed blade. —J. Prophyll of pseudospikelet, abaxial view (left), adaxial view (right). —K. Gemmiparous glume with blade. —L. Gemmiparous glume with apiculum. —M. Lemma with apiculum, adaxially densely strigillose in the upper portion. —N–P. Caryopsis. —N. Embryo view. —O. Hilum view. —P. Lateral view. (Figs. 2A–M based on the type collection *Davidse et al. 16924*, N–P on *Davidse et al. 17318.*)

VEN); forested riverbank of the Brazo Casiquiare between mouth of the Río Pasimoni and Culimacare, 1°53′–1°58′N, 66°50′–66°35′W, elev. 80 m, 25 July 1984, *Davidse 27872* (CANB, COL, INPA, ISC, K, MEXU, MG, MO, NY, P, TULV, US, VEN).

Guadua ciliata is known from the southwestern quarter of Territorio Federal Amazonas, Venezuela, and northwestern Amazonas, Brazil, but is also to be expected in adjoining areas of Colombia. All collections have been made on riverbanks, which are also the habitat of *G. latifolia* and *G. glomerata*. *Guadua ciliata* appears to be much less common than *G. latifolia* based on the populations that Davidse has observed in Venezuela. In Venezuela, all populations of *G. ciliata* had relatively few individuals on high riverbanks that are flooded only infrequently. On the other hand, *G. latifolia* formed extensive colonies on gravel and sandbars and low riverbanks subject to frequent flooding. However, label data for some of the Brazilian collections indicate that *G. ciliata* grows in igapó forest, with the base of the plants submerged in water.

The southernmost collections of *G. ciliata* from Dpto. Río Negro, Amazonas, Venezuela, and two from Amazonas, Brazil (*Liesner 6373*, *Huber & Tillett 6389*, *Davidse & Miller 26665*, *Steward et al. 466*, *Calderón et al. 2985*), differ from the remaining collections by their pubescent culms, pubescent foliage sheaths and subtending bracts, and slightly larger spikelets and auricles.

We thank Bruno Manara for the excellent illustrations, Lynn G. Clark for helpful review comments, and James L. Zarucchi for information about the Spruce collections. Londoño thanks the late Thomas R. Soderstrom for generous guidance in her study of Bambusoideae, José Cuatrecasas for rendering the descriptions into Latin, and the Universidad del Valle and Jorge Ramos for the use of laboratory facilities. Davidse's fieldwork was supported by NSF (INT76-14750) and CONICIT (DDCT-ECO-4). He thanks Otto Huber for the opportunity to participate in the fieldwork.

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A New Species of *Guadua*, *G. calderoniana* (Poaceae: Bambuseae), with Notes on the Genus in Bahia, Brazil

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Guadua Kunth (Poaceae: Bambusoideae: Bambuseae) is a genus of ca. 25–30 species occurring in forests and savannas from Mexico and northern South America to Paraguay and Argentina, with a center of diversity in western Amazonia and the Orinoco basin (McClure, 1973; Young, 1985; Soderstrom & Londoño, 1987, 1988). Until now, no named species have been reported from Bahia, Brazil (Renvoize, 1984). However, study of collections made by C. E. Calderón and T. R. Soderstrom have enabled us to identify three species of *Guadua* from the state: *G. paniculata* Munro, *G. tagoara* (Nees) Kunth, and a new taxon herein described and illustrated. We provide a key to all Bahian representatives of the genus, along with descriptions (terminology follows that of Soderstrom & Londoño, 1988) and lists of specimens examined.

Key to the species of *Guadua* from Bahia, Brazil (based only on Bahian material)

1a. Culms robust, 6–10(–15) cm diam.; culm leaf blades broadly triangular, at most as long as the sheaths; foliage leaf blades 21–30 × 3–7 cm ..... 3. *G. tagoara*

1b. Culms more slender, 2–6 cm diam.; culm leaf blades narrowly triangular, usually longer than the sheath; foliage leaf blades 14–27 × 0.7–3.7 cm.

2a. Foliage leaf blades 15–27 × 2–3.7 cm, ovate- to oblong-lanceolate; sheaths with prominent auricles 5–10 mm long, bearing prominent setae 15–25 mm long; wings of the palea keels glabrous, smooth, ca. 1 mm wide; culm leaf blades persistent ..... 1. *G. calderoniana*

2b. Foliage leaf blades 14–18 × 0.7–1 cm, linear-lanceolate; sheaths rarely auriculate (auricles if present less than 5 mm long), bearing setae only 8–10 mm long; wings of the palea keels silky-pubescent, ciliolate, less than 0.4 mm wide; culm leaf blades caducous ..... 2. *G. paniculata*

1. Guadua calderoniana Londoño & Judziewicz, sp. nov. TYPE: Brazil. Bahia: Mun. Ilhéus, ca. 30 km SW of Olivença on road to Vila Brasil, near Rio Maroim, in flower, 22 Feb. 1979, *C. E. Calderón & T. S. dos Santos 2476* (holotype, CEPEC; isotypes, B, CANB, COL, CTES, F, G, ISC, K, LE, MO, NY, P, PE, PRE, SGO, SI, SP, TULV, US—3 sheets, USCH, W, WIS). Figures 1, 2.

Bambusa lignosa spinosa 10–20 m × 2–3.5 cm; internodia firma, fere solida. *Folia culmorum* coriacea; lamina persistens, erecta, plerumque lanceolato-triangulata, 20–35 cm longa. *Ramificatio* intravaginalis. *Folia* in complemento 12–15; vagina pubescens biauriculata, auriculis falcato-lanceolatis prominentibus longisetosis; setae copiosae, patulae, 15–25 mm longae; lamina ovata-lanceolata vel oblongo-lanceolata, 15–27 × 2–3.7 cm. *Synflorescentiae* indeterminatae, terminales. *Pseudospiculae* lanceolatae, robustae, erectae, bracteis subtendentibus singulis, prophyllo singuli, bracteis gemmiferis 2–4, bracteis vacuis plerumque 1 raro 2, lemma fertilia singula cum rudimento paleae; flosculis 4–10; *lemma* ovato-lanceolatum, 17–27 mm longum, 23–27-nervatum, dorsaliter breviter hirsutulum; *palea* glabra carinis alatis 2, alis 1 mm latis. *Lodiculae* 3. *Stamina* 6, filamentis liberis. *Ovarium* fusiforme, sursum breviter pubescens; stylus singulus; stigmata tria plumosa. *Fructus* cariopsis.

Densely unicespitose woody, thorny bamboo. *Rhizomes* sympodial, pachymorph. *Culms* green, erect when young, bending or arching after developing foliage leaves, 10–20 m tall, 2–3.5 cm diam., sometimes leaning on or pendent from trees; *internodes* 30–35 cm long, terete, smooth or slightly roughened, solid or nearly so with very thick walls and a small central lumen; *nodes* solitary, the sides parallel in longitudinal section, the single nodal line horizontal, an upper nodal ridge also manifest, a dense but inconspicuous band of ca. 1 mm long, appressed, tawny hairs extending about 5 mm below and 10 mm above the nodal line; *bud* solitary, covered by a prophyllum, positioned between the nodal line and the upper nodal ridge, not elevated on a promontory. *Culm leaves* coriaceous, light beige in color when young, later stramineous and deciduous, 30–60 × 7–13 cm (basal width); *sheath* densely strigose abaxially, covered with short, hard, brown or hyaline persistent hairs, shiny and glabrous adaxially, 20–28.5 × 8–11 cm, the summit slightly

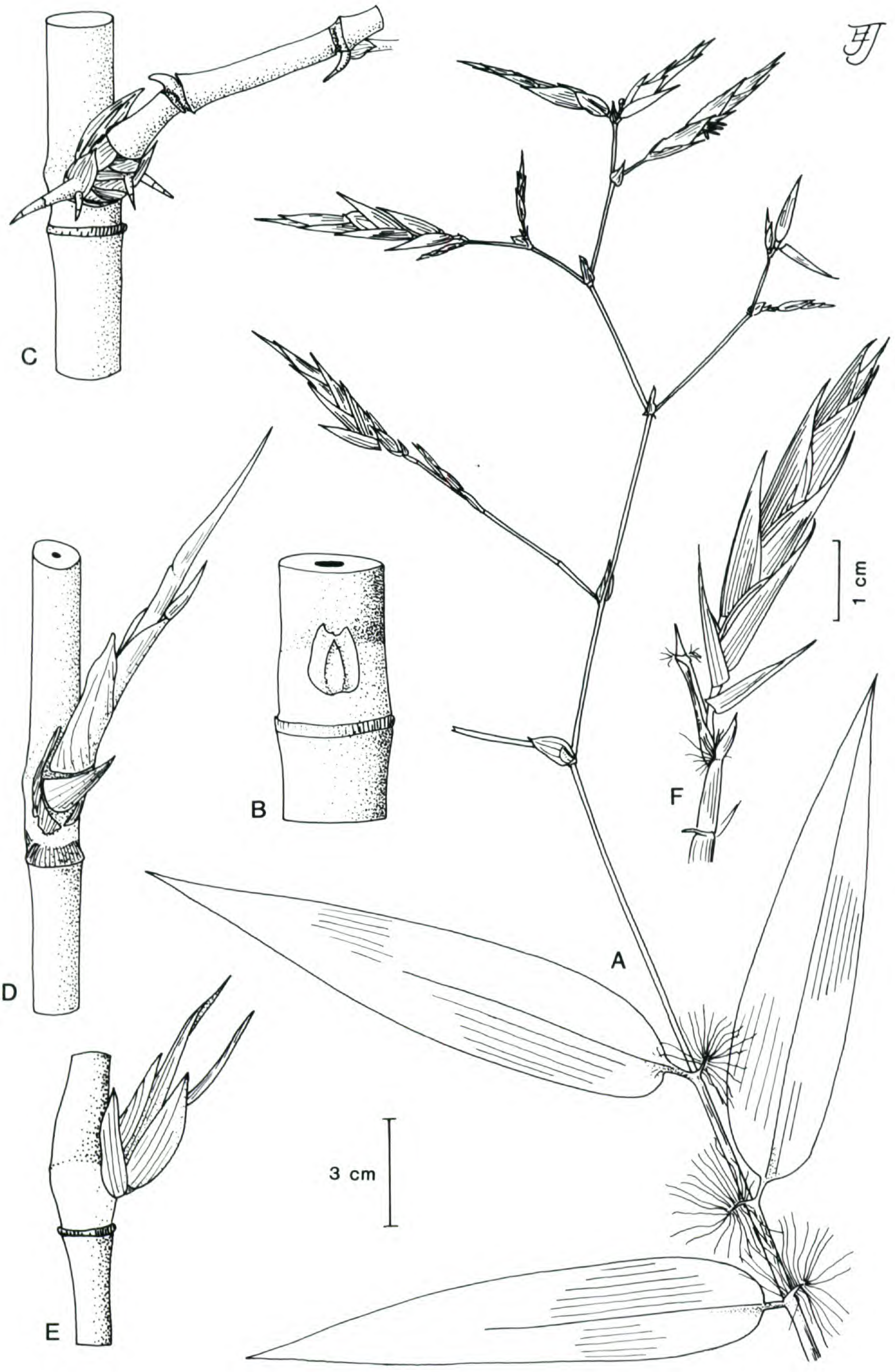

Figure 1. *Guadua calderoniana* Londoño & Judziewicz. —A. Synflorescence terminating leafy branch. —B. Bud at midculm node. —C. Branch at midculm node showing thorns. —D, E. Young branches at midculm node, front and lateral views. —F. Pseudospikelet. (All drawings based on *Calderón et al. 2386.*)

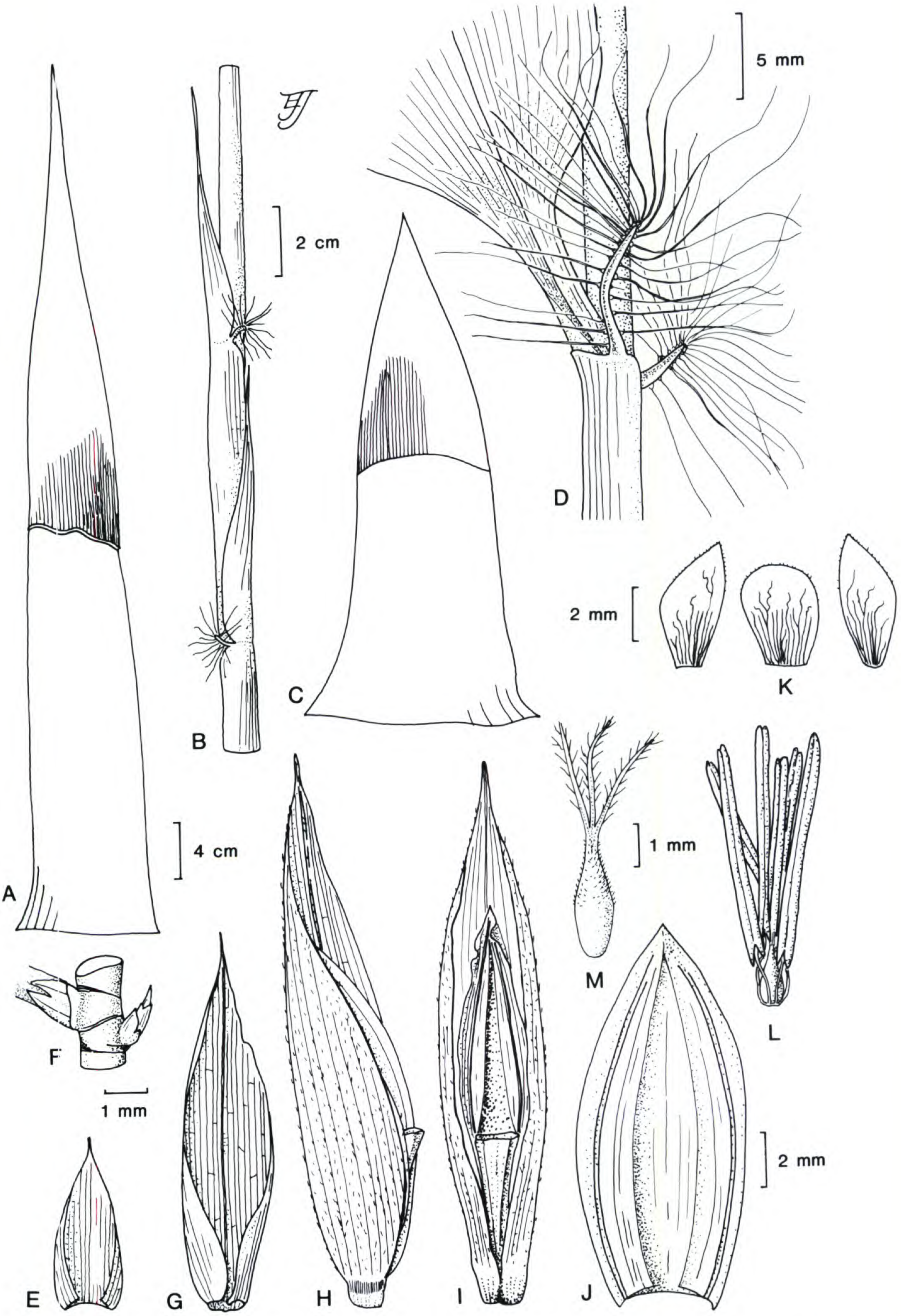

Figure 2. *Guadua calderoniana* Londoño & Judziewicz. —A, C. Culm leaves (spread). —B. Culm leaves in situ, showing auricles and setae. —D. Foliage leaf ligular area, showing prominent auricles and setae. —E. Basal gemmiparous bract. —F. Section of rachilla showing developing bud. —G. Empty bract. —H, I. Floret, lateral and ventral views. —J. Palea, spread ventral view. —K. Lodicules. —L. Androecium of 6 stamens surrounding gynoecium. —M. Gynoecium. (All drawings based on *Calderón et al. 2386.*)

convex, continuous with the blade and confluent with the inner ligule, bearing setose auricles; *auricles* 7–9 mm long, falcate-lanceolate, dark brown, bearing long setae, at length deciduous; *setae* ca. 15 mm long, numerous, arising from the margin and adaxial surface of the auricle, ivory-colored, lustrous, curled distally; *inner ligule* 1.3–3 mm long, membranous, truncate, indurate, stramineous, with ciliolate margins; *outer ligule* absent; *blade* 20–35 × 5–8 cm, equal to or longer than the sheath, or occasionally slightly smaller, persistent, lanceolate-triangular, erect, slightly concave at the base, attenuate-apiculate at the apex, tessellate on both surfaces, abaxially with hard, brown, appressed hairs, these usually denser at the base, adaxially conspicuously nerved with fine, light-brown hairs in narrow, vertical bands, separated by glabrous nerves, the margins smooth. *Branching* intravaginal, solitary and armed, the lowermost nodes developing stout hooked thorns 6–7 cm long, the middle and upper nodes producing a single branch held at a 30° angle, in age developing 2–3 supplemental branches from the basal proximal nodes. *Foliage leaves* borne in lax complements of 12–15 leaves; *sheath* green when young, later stramineous, pubescent on the back, ciliate on the margins, auriculate at the summit, covered with two types of hairs, one type less than 0.05 mm long and densely covering the surface, the other type up to 1 mm long, rigid, hyaline, and perpendicular to the surface; *auricles* 5–10 mm long, falcate-lanceolate, dark brown, glabrous, bearing elongate setae; *setae* 15–25 mm long, arising from the margin of the auricle, slightly curled distally, tawny; *inner ligule* ca. 1 mm long, rimlike, dark brown, ciliolate on the margins; *outer ligule* rimlike, ca. 0.7 mm long, dark brown, puberulent throughout; *pseudopetiole* 5–10 mm long, covered on both surfaces with short, rigid, patent hairs less than 0.5 mm long; *blades* 15–27 × 2–3.7 cm, ovate- to oblong-lanceolate, truncate to rounded at the base above the pseudopetiole, the apex acuminate, symmetrical, glabrous on both surfaces, the midnerve and secondary nerves more prominent on the lower surface, 14–18-nerved, the margins strigose. *Synflorescence* terminating leafy or leafless branches, iterauctant, polytelic, consisting of 4–5 coflorescences with 5–15 multiflowered pseudospikelets in each one. *Pseudospikelets* 4–8 × 1 cm, stout, straight, green when young, later stramineous, comprised of a subtending bract, a prophyll, 2–4 basal gemmiparous bracts, 1(–2) empty bracts, 1 sterile lemma, 4–10 fertile florets, and terminating in a rudimentary floret; *rachilla* green, pubescent, always elongated a little beyond the uppermost gemmiparous bract; *subtending bracts* varying in size and shape throughout the main axis, pubescent, sometimes bearing setae at the summit of the sheath; *prophyll* pubescent, winged, and ciliolate on the keels, asymmetrical, enclosing a floral bud; *basal gemmiparous bracts* commonly 2–4 (mostly 3), approximate, positioned close to the prophyllum, 3–7 × 3–5 mm, broadly ovate to ovate-lanceolate, the apex apiculate with a mucro ca. 1 mm long, pubescent abaxially, shiny and lustrous adaxially, the margins ciliate; *empty bracts* 1(–2), 12–15 × 5–7 mm, caducous; *sterile lemma* 15–18 × 5–7 mm, acuminate at the apex, with a mucro ca. 1 mm long, 23–27-nerved, short-pubescent abaxially, shiny adaxially, the margins ciliate, always enclosing a rudimentary palea. *Florets* stramineous; *lemma* 17–27 × 7–10 mm, ovate-lanceolate, the acute apex with a stiff mucro ca. 1 mm long, 23–27-nerved, abaxially stramineous or green with yellow spots and covered with rigid, hyaline, appressed, patent hairs up to 1 mm long, these denser at the base near the junction with the rachilla, adaxially glabrous and glossy, the margins ciliate, completely embracing the palea; *palea* ca. 15 × 7 mm (spread width), somewhat shorter than the lemma, stramineous, glossy, glabrous, with transverse veins between the keels, 9–11-nerved, slightly bifid at the apex, the keels bearing smooth, glossy, hyaline wings ca. 1 mm wide. *Lodicules* 3, membranous, hyaline, many-nerved, glabrous except for bicellular microhairs on the margin near the apex; anterior pair 4–5 × 2–3 mm, spatulate, their apices obliquely acute; posterior lodicule somewhat shorter but just as wide as the anterior pair, truncate to obtuse at apex. *Androecium* with 6 stamens; filaments filiform, free; anthers 7–10 × 0.5–1 mm, sagittate at the base, with a hair at the apex of each theca, purple. *Gynoecium* with ovary 3–8 × 1 mm, fusiform, glabrous at the base, densely antrorse-hispidulous in the middle and upper portions; style hispidulous; stigmas 3, plumose, purple. *Fruit* a fusiform caryopsis 9 × 2 mm (the single example apparently immature).

Paratype. BRAZIL. BAHIA: Mun. Una, 36 km NW of Una on road to São José, elev. 200 m, edge of recently cleared and cut forest, flowering profusely, 23 Apr. 1976, *Calderón, dos Santos & de Oliveira 2386* (B, CEPEC, F, G, ISC, K, LE, MO, NY, P, SI, SP, TULV, US—7 sheets, USCH).

Guadua calderoniana appears to be the unnamed native bamboo alluded to by Renvoize (1984: 17, as *Bambusa* Schreb.) in his treatment of the grasses of Bahia. It is known only from two collections made in wet forests at elevations of 100–200 m in Bahia, Brazil, south of the cities of Itabuna and Ilhéus. *Guadua calderoniana* differs from all other congeners in the following distinctive combi-

nation of characters: stout, nearly solid culms (Fig. 1B); usually elongate culm leaf blades (Fig. 2A); prominent foliage leaf sheath auricles bearing elongate setae (Fig. 2D); elongate, straight, stout pseudospikelets (Fig. 1F); and short-pubescent lemmas (Fig. 2H). The prominent foliage leaf sheath auricles bearing numerous, elongate setae are particularly distinctive. The affinities of the new species are uncertain.

The specific epithet honors Cleofé E. Calderón, prolific collector of many new tropical American bamboos.

Like many species of the narrow zone of wet forest in coastal Bahia, *G. calderoniana* is endangered by widespread forest cutting (Mori et al., 1983; Soderstrom & Londoño, 1987, 1988), and, more recently, burning of the small remnants that are left, whether or not they are protected in reserves (Burman, 1989).

2. Guadua paniculata Munro, Trans. Linn. Soc. London 26: 85. 1868. *Bambusa paniculata* (Munro) Hackel, Oesterr. Bot. Z. 53: 195. 1903. SYNTYPES: Brazil. Goiás or Tocantins: Rio Tocantins, *Burchell 8852* (BR n.v., fragment and photograph US). Pernambuco: Rio Preto, *Gardner 2981* (fragment US).

Woody and thorny bamboo; culms 5–12 m × 2–6 cm, erect below, arching above, the internodes 25–28 cm long, hollow with walls 3 mm thick, glabrous. *Culm leaves* deciduous, finely pubescent throughout; sheaths 10–20 × 7–18 cm with auricles absent or rarely present and up to 2 mm long; inner ligule 1–2 mm long; outer ligule absent; blades 14–22 × 6–9 cm, triangular, caducous. *Foliage leaves* with sheaths usually glabrous; auricles if present up to 5 mm long, bearing setae 8–10 mm long; pseudopetiole 2–3 mm long, short-hirsute; blades 14–18 × 0.7–1 cm, linear-lanceolate, pubescent on both surfaces. *Synflorescence* with axes pubescent. *Pseudospikelets* 2–3 cm × 2–4 mm, slightly arcuate, 4–6-flowered; lemma 5–7 × 3–5 mm, silky-pubescent on both surfaces; palea 6–8 × 2–4 mm, exceeding the lemma, silky-pubescent, the keels ciliolate with inconspicuous wings less than 0.4 mm wide.

Distribution: Guadua paniculata is found in a variety of wet to seasonally dry habitats below 1,000 m from Mexico and northern South America to Bolivia, Paraguay, and southern Brazil (Santa Catarina). It is a somewhat polymorphic species that has not yet been well studied.

Specimen examined. BRAZIL. BAHIA: Mun. Andaraí, Serra do Sincorá, 9 km S of Andaraí on road to Itaeté, elev. 360 m, 12 May 1976, *Calderón, Santos & Oliveira 2433* (CEPEC, US).

3. Guadua tagoara (Nees) Kunth, Enum. Pl. 1: 434. 1833. *Bambusa tagoara* Nees, Agrost. Brasil. 532. 1829. TYPE: Brazil. São Paulo: Serra do Mar, towards Guarantinguetá, *Martius s.n.* (holotype, M? n.v.).

Woody and thorny bamboo; culms 20–30 m × 6–10(–15) cm, erect, arching above, the internodes hollow, scabrous. *Culm leaves* deciduous, covered with fine appressed brown hairs; sheaths 17–38 × 20–30 cm, lacking auricles and setae; inner ligule 2–4 mm long; outer ligule absent; blades 3–7 × 9–13 cm, very broadly triangular, erect, persistent. *Foliage leaves* with sheaths ciliate on the margins and often with a line of hairs on one side of the midnerve, otherwise glabrous; auricles absent or rarely present and up to 5 mm long, bearing setae 8–10 mm long at the summit; pseudopetiole ca. 10 mm long, glabrous; blades 21–30 × 3–7 cm, broadly ovate-lanceolate, glabrous. *Synflorescence* with axes glabrous. *Pseudospikelets* 1–3 cm × 3–6 mm, straight, 4–6-flowered; lemma 6–8 × 5–7 mm, papillose abaxially, silky-pubescent adaxially, ciliate on the margins; palea 7–9 × 3–5 mm, exceeding the lemma, puberulous, the keels with puberulent, ciliolate wings ca. 1 mm wide.

Distribution: Wet forest edges below 1,000 m in eastern Brazil (Bahia to Santa Catarina).

Specimens examined. BRAZIL. BAHIA: Mun. Itajuipé, 2 km S of Pimenteira on road to União Queimada, Fazenda São Jorge, elev. 500 m, 5 May 1976, *Soderstrom, Russell & Hage 2186* (CEPEC, US); Mun. Gandú, 2 km N of Gandú City on BR-101, Fazenda Santo Antonio, ca. 13°44′S, 39°29′W, 19 Apr. 1972, *Calderón & Pinheiro 2228* (CEPEC, US); Mun. Mascote, 20 km E of Camacâ, 9 km W of Sânta Luzia do Salobro on road to Canaveiras, edge of Rio Belém, elev. 90 m, 7 Apr. 1976, *Soderstrom, Russell & Hage 2128* (CEPEC, US); Mun. Jequié, ca. 40 km SE of Jequié on road to Ipiaú, elev. 175 m, 16 May 1976, *Calderón, dos Santos & Oliveira 2439* (CEPEC, US).

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Quiotania: A New Genus of Apocynaceae–Apocynoideae from Northern Colombia

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During fieldwork carried out as part of a counterpart collecting program between the Missouri Botanical Garden and the Universidad de Antioquia in Medellín, Colombia, a previously unknown laticiferous vine was collected twice by the author in a span of four days in late 1986. Both of the collecting localities lie at mid elevation in the western watershed of the Río Magdalena in south-central Antioquia.

Quiotania colombiana Zarucchi, gen. et sp. nov. TYPE: Colombia. Antioquia: Mpio. de La Unión, Km 33 of road Sonsón–La Unión (23 km from La Unión), 5°52′N, 75°08′W, alt. 2,330 m, 8 Dec. 1986 (fl), *Zarucchi & Bedoya 4510* (holotype, HUA-33422; isotypes, COL [specimen distributed from HUA], K, MO). Figure 1.

Fruticosa volubilis, *Mandevillae* et *Tintinnabulariae* affinis; folia opposita petiolata membranacea ad subcoriacea, supra nervo medio inconspicue glanduligero, subtus in axillis nervi medii foviis destituta; inflorescentia lateralis pedunculata multiflora congesta; corolla regularis 5-partita, pallide lutea, tubo brevi; fructus ignotus, verisimiliter folliculus apocarpus.

Twining lactescent, heliophytic vines. Stems terete, 2.0–2.5 mm diam. with young stems purplish brown, moderately to sparingly hispidulous, becoming lenticellate and glabrous with age; very young stems somewhat flattened; interpetiolar ridge mostly prominent; exuded latex white. Leaves opposite, entire, brochidodromous, membranaceous to subcoriaceous, elliptic to oblong-ovate in outline, 3–5(–6) cm × 1.2–1.8(–2.2) cm, glabrous on both surfaces, usually with 11–16 pairs of lateral nerves, apex acute to short acuminate with extended tip, base rounded to subacute, midrib prominent below, prominulous above, lateral veins very slightly impressed above, neither raised nor impressed below but darkening upon drying; midrib glanduliferous above within ca. 2 mm of attachment with petiole with 1 (rarely 2) pair of sharply conical or urn-shaped and divergent glands; lacking foveae in axils of lateral nerves on lower surface; petioles 4–7(–8) mm long, hispidulous, slightly canaliculate. Inflorescence an axillary or pseudo-terminal (i.e., axillary to a terminal bud which soon elongates) racemose cyme; peduncle 5–12 mm long, densely hirtellous. Flowers (8–)12–20 per inflorescence and generally tightly clustered along the axis and thus approaching a pseudo-umbellate condition, pale yellow; floral bracts 1.5–2.0 mm × 0.25–0.3 mm, narrow, acuminate, caducous. Calyx 5-parted with lobes equal or subequal, ovate, 2.0–2.5 mm × 1.0–1.3 mm, separate nearly to the base, quincuncially imbricate, ciliate, apex acute to acuminate, abaxial surface centrally tomentose becoming diminished toward the margins and apex, adaxial surface essentially glabrous; colleters basal, two with each ca. 0.5 mm × 0.2 mm, flattened, thin, slightly zigzag in outline, located just within the margin of the sepal. Corolla fused into a straight tube, 2.5–3.0 mm long, very slightly constricted at the base; lobes 5, overlapping to the right, asymmetrical in outline, 2.5–3.0 mm × 2.0–2.5 mm, apex acute to somewhat rounded; tube and limbs glabrous outside, densely tomentose just below opening of tube and with a ring of five ± arching hispidulous patches opposite the top of the glands surrounding the ovary. Stamens 5, agglutinated to the stigmatic head; filaments mostly adnate to the corolla tube but free, geniculate, and tomentose for their ultimate 0.5–0.6 mm; anthers somewhat exserted but enveloped by the corolla lobes, ca. 2 mm × 0.6–0.7 mm, with parallel thecae, their basal lobes slightly auriculate; pollen granular. Ovary composed of two falcate-botuliform, separate carpels, 0.6–0.7 mm high, rounded at the top with the styles becoming joined just above the ovary, each carpel with 15–20 ovules in 3–4 series attached to the adaxial placentae; ovarian nectaries 5, tightly surrounding and nearly as tall as the ovary, apices rounded, free or connate in the basal half. Stigmatic head short-conical and five-angled in cross section, 0.7–0.8 mm high and 0.6–0.8 mm diam. at its base with a bifid acumen 1.2–1.3 mm long divided for the ultimate ca. 0.5 mm; the five basal projections generally obclavate with two rounded lateral projections basally. Fruits and seeds unknown [probably twin follicles attached at the apex, at least during development, each with few to many seeds having an apical coma].

Figure 1. *Quiotania colombiana* Zarucchi. —A. Habit. —B. Flower. —C. Dissected flower showing calyx, ovary, glands, style, and stigmatic head. —D. Agglutinated anthers. —E–F. Single anthers. —G. Leaf base with glands. Drawn from *Zarucchi & Bedoya 4510.*

Distribution and habitat

Quiotania colombiana is known only from two collections from wet to very wet remnant forest at mid elevations of north-central Colombia in the western watershed of the Río Madgalena in the Department of Antioquia. Both gatherings were made in areas with high light intensity, at the edges of moderately to highly disturbed forest.

Paratype collection. COLOMBIA. ANTIOQUIA: Mpio. de Guatapé, ca. 8 km NNE of Guatapé, Vereda Santa Rita, Finca Montepinar, 6°17′N, 75°08′W, alt. 1,840 m, 4 Dec. 1986 (fl), *Zarucchi 4391* (COL [specimen distributed from HUA], HUA, MO, US).

The new generic name is an anagram of the Colombian department where the plant was collected. The specific epithet denotes the country.

Conservation status

The general area in which the two collections were made has been subjected to considerable deforestation and related human pressures, yet it appears from field observations that the plant tolerates even heavy disturbance. With diligent field searches in similar habitats, it is likely that one could locate the species growing between 1,500 and 2,500 m on the eastern part of the Cordillera Central from central Antioquia southward at least into the neighboring Department of Caldas.

It is quite surprising to discover a new genus of Apocynaceae in the northern Andes of Colombia, especially when one of the two known localities lies a proverbial "stone's throw" from the old road connecting Colombia's two largest cities, Bogotá and Medellín. The newly discovered plant was found at the edge of openings, within several meters of a stream bank at 2,330 m (4510) and also along a cleared powerline right-of-way at 1,840 m (4391). Both collections were gathered from flowering plants that had no fruits. The plants at the type locality have been revisited on three subsequent occasions, and each time the plants have been found to be sterile. In the field the plant closely resembles a milkweed by its foliage, nature of the inflorescence, and appearance of the flowers. This same initial confusion in the field has also been associated with the Mexican/Guatemalan genus *Thenardia*, which has diffusely compound umbelliform cymes (W. D. Stevens, pers. comm.).

In introductory comments about members of the subfamily Echitoideae [= Apocynoideae], Woodson (1933) mostly limited his remarks to the New World members and noted the ". . . perplexing problem . . . concerning generic relationships." In this first part of his three-part treatment of these American Apocynaceae, Woodson distinguished an assemblage of four genera, *Allomarkgrafia*, *Mesechites*, *Macrosiphonia*, and *Mandevilla*, from the remaining New World genera based on their anthers with thick obtuse basal or truncate auricles, the pentagonal stigma, and leaves generally having glands on the midrib above. Members of *Forsteronia* subg. *Forsteronia* have glands at the base of the midrib, but Woodson placed *Forsteronia* with other genera based on anther and stigmatic characters. In the concluding part of the monumental treatment, Woodson (1936) described *Tintinnabularia* from Guatemala, placing it among the four above-mentioned genera. These genera were again treated by Woodson (1938) in the Apocynaceae for the North American Flora, where he provided a slightly revised key to the genera. Certain exceptions to the differences as pointed out for the initial four were noted in Woodson's 1933 discussion and in his key to the genera, especially the fact that most species of *Forsteronia* also bear the same foliage glands (see Hansen, 1985). Woodson also noted that in many species of *Mandevilla* subg. *Exothostemon* the glands are scattered along the midrib, not just aggregated near the petiole attachment. The last word concerning generic limits of the *Mandevilla–Mesechites–Macrosiphonia* complex and near relatives has obviously not yet been written.

It is not clear to which genus *Quiotania* might be most closely related. *Quiotania*, *Mandevilla*, and *Macrosiphonia*, as they are currently circumscribed, have unbranched inflorescences, whereas *Allomarkgrafia*, *Mesechites*, and *Tintinnabularia* have branched inflorescences. *Tintinnabularia* (and the neotropical genera *Forsteronia* and *Malouetia*) has domatia on the abaxial surfaces of the leaves, generally in the central vein axils; specimens of the two collections of *Quiotania* do not exhibit leaf domatia. Hansen (1985) has noted, at least in the case of *Forsteronia*, that "domatia may be present or absent from leaf to leaf and from specimen to specimen, and are completely lacking in only a few taxa." The usefulness of domatia as a character is therefore questionable. It is clear from floral characters, especially the lack of a pronounced corolla tube, that *Quiotania* is distinct from *Mandevilla*, the genus where one would place the new taxon using Woodson's 1938 key in North American Flora.

Following the various studies by Woodson on the family Apocynaceae, Pichon (1950) treated the family at the generic and infrageneric level on a worldwide basis. In the 1950 work, a close relationship between the genera having leaf glands was retained. Pichon erected five subtribes within his "tribu des Ichnocarpées," including Mandevillinae with three genera: *Mesechites* (including *Allomarkgrafia*), *Mandevilla* (including *Macrosiphonia*), and the Argentinean–Chilean *Elytropis*. Pichon did note, however, that this last-named, monotypic genus might best represent its own subtribe. A separate subtribe, Forsteroniinae, included only *Forsteronia* and *Tintinnabularia*. Pichon's subsuming of *Allomarkgrafia* and *Macrosiphonia* in the other genera has generally not been followed by current systematists.

Fruiting collections of *Quiotania* will surely shed more light on its position within the subfamily. It is clear that additional studies are needed, including phenetic and cladistic analyses of all genera in the Apocynoideae and representative genera in the Asclepiadaceae and less advanced groups of the traditional Apocynaceae. It is also clear that the highly elaborated relationship between the gynoecium and

surrounding stamens in these advanced members of the Apocynaceae (sens. str.) and Asclepiadaceae may have a much closer phylogenetic relationship with each other than with "primitive" Apocynaceae, such as those of the tribe Ambelanieae (Zarucchi, 1988).

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A New Species of *Parahancornia* Ducke (Apocynaceae: Plumerioideae: Carisseae) with Comments on the Genus

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In early 1944 there appeared a revision of the apocynaceous genera *Couma* and *Parahancornia* (Monachino, 1943), being part of a series of papers by the author dealing with the taxonomic study of those laticiferous plants of this family with potential as sources of chicle for the manufacture of chewing gum. These taxonomic studies, carried out with support from the Chicle Development Company, were based in large part on the then-recent collections made by B. A. Krukoff, Ricardo de Lemos Fróes, and others. In his revision, Monachino succinctly pointed out the differences that separate *Parahancornia* from *Couma*. The most important and easily observable characters that distinguish *Parahancornia* from *Couma* are employed in the following key:

Leaves in whorls of 3–4(–5); inflorescences axillary (sometimes developing simultaneously with the terminal vegetative shoot); calyx 5-parted . . . . . *Couma*
Leaves opposite; inflorescences terminal; calyx usually 4-parted . . . . . *Parahancornia*

In the revision by Monachino, the necessary transfers from *Couma* to *Parahancornia* were made, and he further described three new species in the latter genus including *P. negroensis*. Based on the present author's field experience in the Vaupés of eastern Colombia, combined with the study of specimens in various herbaria, including those collections actually seen by Monachino for his study, it is clear that Monachino included specimens of two different yet superficially similar species under the name *P. negroensis;* some of these differences between the type and six paratype collections were even noted by Monachino in the species protologue. Because of this conclusion, a new species in the genus is here proposed.

Parahancornia surrogata Zarucchi, sp. nov. TYPE: Colombia. Vaupés: Mitú and vicinity, Río Paraná–Pichuna, savanna at major rapids, 18 July 1979 (fl, fr), *James L. Zarucchi 2493* (holotype, COL-211365; isotypes, GH, K, MO, USF, WAG). Figures 1–5.

Arbor lactifera plerumque ad 10 m alta, *Parahancorniae negroensi* affinis et cum ea usque adhuc confusa; inflorescentiae terminales, adscendentes, 20–50(–90)-florae, floribus albidis; folia opposita, coriacea, nervis secundariis vulgo 7–11 regulariter arcuatis vix distinctis, et reticulo obscuro instructa.

Small tree usually less than 10 m, but reported to 20 m tall. Bark light gray with fine vertical and horizonal fissures. Wood cream-colored, soft, easily cut. Latex white, moderately thick, sticky, and very bitter tasting. Leaf-bearing branches terete up to 7 mm diam., youngest branches somewhat flattened, and the leaf-bearing branches becoming slightly swollen just below the nodes. Leaves opposite, obovate, 4–6 cm long, 1.5–2.5 cm wide, thick-coriaceous with 7–11 pairs of lateral veins; apices rounded to obtuse; bases cuneate becoming slightly decurrent on the petiole; leaf blade flat with margins entire; midrib slightly impressed above and prominent below, especially near base of the blade; lateral veins nearly obscure above and barely visible below, due mostly to their lighter color; petioles 2.5–5 mm long, shallowly canaliculate. Inflorescences terminal, cymose, lax, 20–50(–90)-flowered, 6–9 cm tall with axes white to cream-colored; common peduncle 3–14 mm long to first pair of axillary branches; bracts ovate to deltoid, ca. 1 mm long and 0.8–1 mm wide; pedicels 8–15(–30) mm long, thin, terete; bracteoles usually on distal third of pedicel. Flowers white, sweetly scented with mature buds attaining 15–20 mm long prior to anthesis. Calyx usually 4-parted and generally immediately subtended by several bracteoles; sepals 1–1.2 mm long and 0.8–1.1 mm wide, joined basally with the outer pair slightly larger than the inner ones, apices acute becoming ultimately rounded, margins finely ciliate. Corolla 5-parted with tube straight, 9–11 mm long, slightly dilated at the base and with a conspicuously dilated zone at the point of insertion of the stamens ca. 6 mm from the base, and the distal half of the tube becoming thickened leaving a small-diametered entrance into the flower; lobes oblong, 6–7 mm long and 2 mm wide, the outside becoming densely very short-pubescent basally and extending along distal part of the corolla tube. Stamens 5, with the fila-

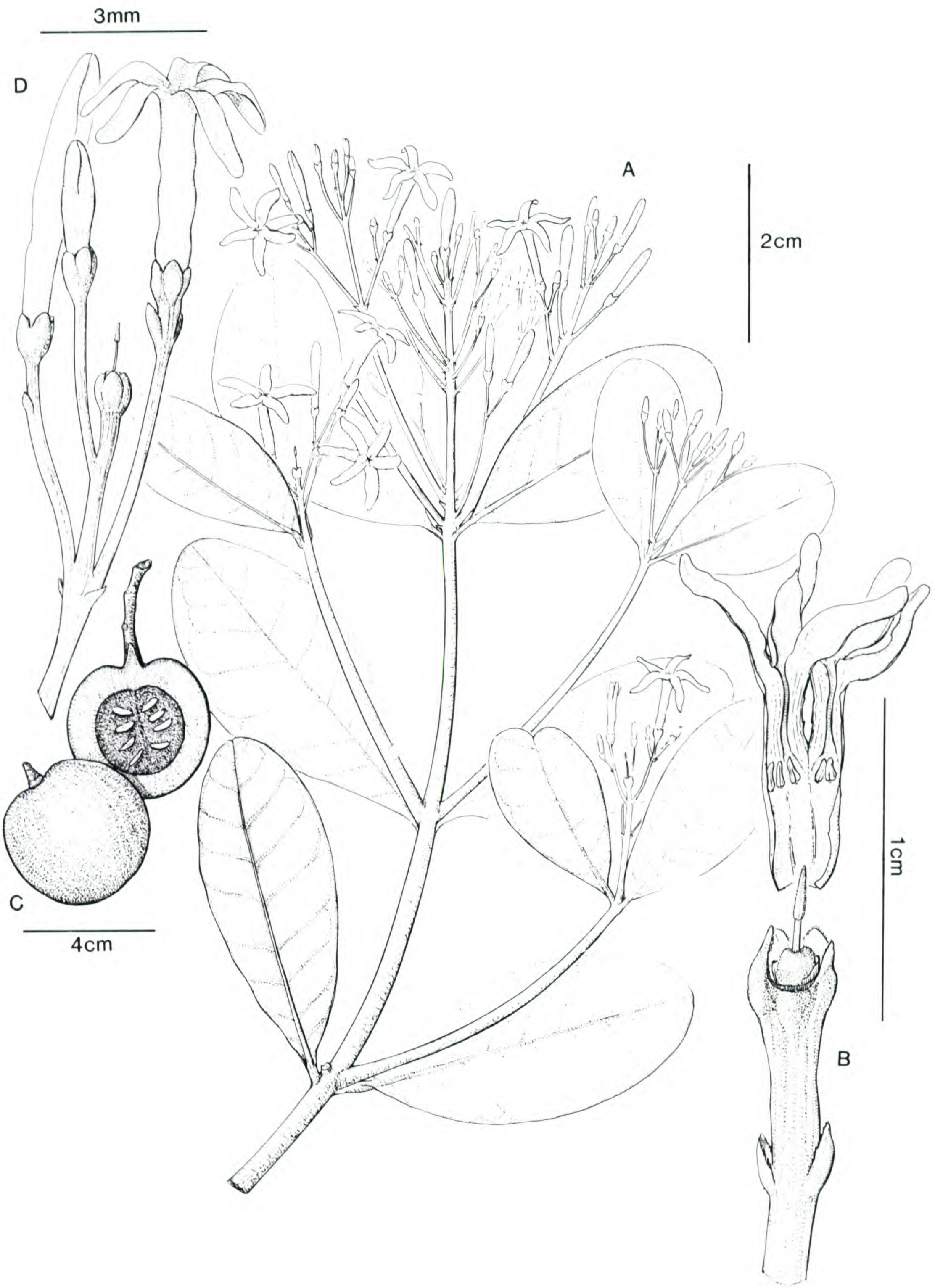

Figure 1. *Parahancornia surrogata* Zarucchi. —A. Habit. —B. Flower. —C. Fruit in cross section showing seeds embedded in pulp. —D. Portion of inflorescence showing flower buds and open corollas. (A, C, D from *Zarucchi 2493*; B from *Zarucchi 2462*.)

Figure 2. Trunk with slash exuding white latex of *Parahancornia surrogata* Zarucchi (*Zarucchi 2494*).

ments adnate to the corolla tube; anthers long-ovate, 1.4–1.6 mm long, opening by longitudinal slits; pollen granular; ovary conical-ovoid, 0.6–0.8 mm long, pubescent; style thin, terete, 2.5–3 mm long surmounted by a gently tapering conical clavuncle or stigmatic head 0.7–0.8 mm long and 0.15–0.2 mm diam. with a slightly swollen ring of tissue basally and with two distal, divergent stigmoid lobes ca. 0.2 mm long. Fruit a berry, globose, 4–6(–8) cm diam., 12–20(–30)-seeded, becoming black when mature; pericarp 7–9 mm thick, somewhat leathery; when mature the pulp surrounding the seeds becomes sweet and edible. Seeds plano-convex, 8–10 mm long, 4–5 mm wide, 2–2.5 mm thick; testa smooth. Embryo ca. ⅔ length of seed, with cotyledons ovate, thin, 3–4 mm long and 2–3 mm wide; radicle straight, terete, 2–2.5 mm long.

Common names: Pendare, Juansoco de la Sabana, and mi-mi-WAHO-ka-ki (Kubeo language). The epithet used for this species refers to the former treatment of specimens of this species under the name *Parahancornia negroensis*.

Key to distinguish *Parahancornia surrogata* from *P. negroensis:*

Inflorescences with 20 or more flowers; leaves with 7–11 pairs of secondary veins that are barely visible on the lower surface, tertiary venation not apparent ..... *P. surrogata*

Inflorescences with fewer than 10 flowers; leaves with 10–15 pairs of secondary veins that are prominently raised on the lower surface with intersecondaries and tertiary venation easily discernable ..... *P. negroensis*

Additional specimens of Parahancornia surrogata *Zarucchi* (an asterisk following a collection number denotes a paratype collection of *P. negroensis* Monach.): BRAZIL. AMAZONAS: Rio Uaupés, Luis Lira, 12 July 1940 (st), *Adams 50** (US); Fóz do Içana, caatinga baixa, 17 May 1948 (fr), *Black 48-2721* (MO, RB); basin of Rio Negro, Munic. São Gabriel, Ca-te-Espera, 17 Nov. 1941 (young fr), *Fróes 376a** (F, G, GH, NY, P, UC, US, WIS), *377** (G, NY, US), 18 Nov. 1941 (fr), *Fróes 379** (G, NY, US); basin of Rio Negro, Santa Ana on Rio Içana, 18 Dec. 1941 (st), *Fróes 438** (G, NY, US), *439** (G, NY, US); 18 Nov. 1945 (fr), *Fróes 21415* (F, IAN, K, NY, RB, US); Rio Içana, praia dos Patos, 27 Mar. 1952 (fr), *Fróes 28064* (IAN, NY, Z); Rio Japurá, Q.SA-19-XB, 67°11′W–0°05′S, 18 Apr. 1975 (fr), *Nascimento et al. 153* (IAN, MG, Z); Cucuí, 29 Apr. 1975 (fr), *Nascimento et al. 240* (IAN, Z); Boca do Rio Uaupés, Feb. 1959 (st), *Pires et al. 7595* (IAN); Iauareté, margem do Rio Uaupés, 67°10′W, 1°19′N, Q.NA-19-YB, 4 June 1975 (st), *Ribeiro 1052* (IAN, MG); alto Rio Negro, Karacuá, Feb. 1959 (st), *Rodrigues 1121* (INPA). COLOMBIA. AMAZONAS: Río Caquetá, Araracuara, Sabana de la Angostura, alt. 400 m, 21 Dec. 1951 (fr), *García-Barriga & Schultes 14175A* (COL, GH, NY, US); Río Caquetá, Araracuara, 5 Sep. 1959 (young fr), *Maguire*

Figure 3. Inflorescence and flowers of *Parahancornia surrogata* Zarucchi (*Zarucchi 2462*).

Figure 4. Pendulous fruits of *Parahancornia surrogata* Zarucchi (*Zarucchi 1212*).

et al. 44108 (NY). GUAINÍA: Río Inirida, Matraca, no date (st), *Crosse 12888/3* (US); ca. 0.5 km N of Boca de Casiquiare (where Ríos Negro, Guainía & Casiquiare join), S side of caño, 1°57′N, 67°07′W, alt. 120 m, 5 Feb. 1980 (fl buds, fr), *Liesner & Clarke 9095* (MO); Río Negro, at confluence of Ríos Guainía and Casiquiare, Caño Ducuruapo (Igarapé Rana), 13–17 Dec. 1947 (fr), *Schultes & López 9397* (IAN, MO); Río Guainía basin, Río Naquieni, vicinity of Cerro Monachí, June 1948 (fr), *Schultes & López 10109* (GH, NY). VAUPÉS: Río Papurí, vicinity of Santa Teresita, 15 Aug. 1943 (st), *Allen 3066* (COL, MO); Río Cuduyarí, "Yapobodá," 23 Jan. 1944 (fr), *Allen 3260* (G, MO); Río Kuduyarí, Sabana con arenisca de Yapobodá, alt. ca. 350–400 m, 25 June 1958 (fl), *García-Barriga et al. 15898* (COL); Alto Río Papurí, sabana en el varador de maloca de Candido a Acaricuara, 5 Jan. 1977 (fr), *Patmore & Dufour 14* (ECON); Alto Río Papurí, catinga entre el Río Papurí y Caño Yapú, 5 May 1977 (fr), *Patmore & Dufour 109* (ECON, K); Río Vaupés, Cerro Circasia, Mar. 1944 (fr), *Schultes 5859A* (COL, MO); Río Piraparaná (tributary of Río Apaporis), Cerro E-ree-eé-kö-mee-ö-kee, 18 Sep. 1952 (fr), *Schultes & Cabrera 17534* (BM, GH, MO, US); Río Kubiyú (tributary of Río Vaupés), Cerro Kañendá, savannas about 15 mi. upstream from mouth, ca. 1°0′N, 70°15′W, alt. ca. 800–900 ft., 10 Nov. 1952 (fr), *Schultes & Cabrera 18368* (GH, MO, US); Río Vaupés, Circasia, ca. 0°45′N, 70°30′W, alt. ca. 800 ft., Nov. 1951 (fl buds, young fr), *Schultes & Cabrera 19683* (GH, MO, NY, UC, US); Río Paraná Pichuna (tributary of Río Vaupés), ca. 1°10′N, 70°30′W, alt ca. 700 ft., June 1953 (fl), *Schultes & Cabrera 19941* (MO, US); Río Kuduyarí, savanna of Yapobodá, 16 Aug. 1960 (st), *Schultes 22616* (ECON); Mitú and vicinity, lower Río Kubiyú, sandstone savanna, 15 Apr. 1975 (fr), *Zarucchi 1212* (COL, ECON, US); 27 Apr. 1975 (st), *Zarucchi 1287* (COL, GH, MO); 13 July 1979 (fl, fr), *Zarucchi 2456* (COL, GH, K, MO); 14 July 1979 (fl), *Zarucchi 2462* (COL, GH, K), *2464* (COL, GH, K, MO), *2465* (COL, GH, K, MO), *2466* (COL, GH, K, MO); 16 July 1979 (fl), *Zarucchi 2484* (COL, GH, K, MO); 30 June 1976 (fl), *Zarucchi & Balick 1788* (COL, ECON, GH, K, MO); Mitú and vicinity, Río Paraná–Pichuna, sandstone savanna at major rapids, 2 July 1975 (fr), *Zarucchi 1376* (COL, GH, MO); 18 July 1979 (fl fr), *Zarucchi 2494* (COL, GH, MO). VENEZUELA. AMAZONAS: Depto. Casiquiare, alrededores de Yavita (Río Temi) y cerca de la carretera Yavita–Pimichín hasta el km 5 hacia Pimichín, alt. 125–140 m, 6–19 July 1969 (fl), *Bunting et al. 3885* (U); Depto. Atabapo, cerca del Caño Yagua, en el piedemonte oeste del Cerro Cucurital, al nor-este del Cerro Yapacana, 3°45′N, 66°32′W, alt. ca. 125 m, 27 May 1981 (fr), *Guanchez 1278* (MO); Depto. Río Negro, sobre altiplanicie en la Serranía del Vinilla (aprox. 20 km SW de Mavaca) hacia el borde SW de la meseta, 2°20′N, 65°22′W, alt. ca. 760 m, 13 June 1981 (fl), *Huber 6170* (MO); 12 km NE of San Carlos de Río Negro, ca. 8 km N of the road, 1°57′N, 67°03′W, elev. 120 m, 22 Sep. 1983 (st), *Kapos & Tanner 136* (MO); Río Guainía, sabanita 1 km E of Maroa, alt. 125 m, 16 Apr. 1953 (fl), *Maguire & Wurdack 35677* (MO, NY, US); Depto. Río Negro, vecinidades y al N del Cerro Vinilla, 2°31′N, 65°23′W, ca. 30 km al SSW de Ocamo, alt. 440–600 m, 1–2 Mar. 1984 (fl), *Steyermark et al. 130389* (MO, VEN).

Common names. Brazil: Cumá (*Adams 50*), Cumaí (*Rodrigues 1121*); Coumahy (*Fróes 376a, 377, 378*), Coumahy da caatinga (*Fróes 438, 439*), Sôrva (*Fróes 376a, 377, 378*), Sôrva pequena (*Adams 50*). Colombia: da-WAHO-ka-ki (Kubeo language; *Zarucchi 2462, 2464-2466*); Di Juwj-wak-so-guh (Tucano language; *Allen 3066*); Juanchoco (*Zarucchi 1212, 1287, 1376*); Juansoco de la Sabana (*Zarucchi 2462, 2464-2466, 2484, 2493-2494*); Juansoko de la sabana (*Patmore & Dufour 14*); mi-mi-WAHO-ka-ki (Kubeo language; *Zarucchi 2456, 2484, 2493-2494*); Na (Tatuyo language; *Patmore & Dufour 14, 109*); Pendare (*Zarucchi 2462, 2464-2466, 2484, 2493-2494*); ran˜-han (Taiwano language; *Schultes & Cabrera 17534*). Venezuela: Pendari (*Maguire & Wurdack 35677*).

Additional specimens of Parahancornia negroensis *Monach.*: BRAZIL. AMAZONAS: Igapó do Rio Negro, boca do Rio Branco, 2 July 1976 (fr), *L. Coêlho 539* (INPA, MG); Rio Negro, Santa Izabel, loco Quatiá, ad ripas, 8 Dec. 1936 (fl), *Ducke RB 30114* (G, INPA, P, U, US); basin of Rio Negro, Mun. São Gabriel, Rio Uenuichi, Matosinho, 21 Mar. 1942 (fl, fr), *Fróes 800* (holotype, NY; isotypes, F, G, GH, K, MO, NY, P, UC, US); 18 May 1947 (fl, fr), *Fróes 22346* (IAN, NY, RB, U); Rio Negro, São Felipe, Igarapé Tourrí, 27 Sep. 1952 (fl, fr), *Fróes 28774* (A, COL, IAN, NY). VENEZUELA. AMAZONAS: Depto. Río Negro, Río Pasimoni, between its mouth and its junction with the Río Baria and the Río Yatua, 1°53′–1°27′N, 66°35′–66°32′W, elev. 80 m, 23–25 July 1984 (fr), *Davidse 27759* (MO, US, VEN n.v.); Río Casiquiare, Jan.–Feb. 1969 (fl), *Fariñas et al. 682* (MO, NY, VEN); Caño de Javita, June 1854 (fl), *Spruce 3711* (K); Río Temi, Yavita, alt. 280 m, 21 Jan. 1942 (young fr), *Ll. Williams 13865* (F, US); Río Guainía, Caño de San Miguel, alt. 127 m, 23 Mar. 1942 (fl, fr), *Ll. Williams 14850* (F, MO, US); en la isla de Trapichote, Delta del [Río] Ventuari, alt. 125 m, 21 Apr. 1942 (fr), *Ll. Williams 14994* (F, G, MICH, MO, RB, US); along Caño San Miguel just above Limoncito (15 km from Río Guainía), alt. 100–140 m, 28 June 1959 (fl), *Wurdack & Adderley 43225* (MAD, NY, US, VEN).

Common names. Brazil: Molongó (*Ducke RB 30114, Fróes 800*). Venezuela: Palo de Boya (*Ll. Williams 14850, 14994*); Pendare rebalsera (*Ll. Williams 13865*).

Discussion

In his description of *Parahancornia negroensis*, Monachino cited a total of seven collections from the northwestern Amazon of Brazil. The citation of these collections (*Adams 50, Fróes 376a, 377, 379, 438, 439, 800* [type]) was followed by the following paragraph: "The type of this species differs slightly from the other specimens cited in that the leaves are less coriaceous, the secondaries clearly visible (up to 15 pairs), connected at the leaf-margins, the tertiaries sometimes apparent. The style is very short (flowers parsitized), the stigma sharply conic." These characters, along with several concerning the inflorescence, including the much greater number of

Figure 5. Habitat and habit of *Parahancornia surrogata* Zarucchi in Colombian Vaupés (individual at center of picture)—population from which *Zarucchi 1212* was collected.

flowers per inflorescence, distinguish *P. surrogata* from *P. negroensis*.

Distribution and Ecology

The distribution and ecology of *Parahancornia surrogata* are very similar to that for *Molongum lucidum* (HBK) Zarucchi (Zarucchi, 1987) in that the species is found in Brazil, Colombia, and Venezuela at elevations generally under 400 m (see Fig. 6). Both of these species of Apocynaceae inhabit the lowland quartzitic sandstone savanna formations that are scattered throughout northwestern Amazonia, existing in sandy soils containing little organic matter. Individuals are usually found along water courses in the open savanna, in the bordering gallery forest, or sometimes in the adjacent forest along streams with a generally open canopy. The westernmost gatherings for both of these apocynaceous species is near Araracuara on the Río Caquetá, Amazonas, Colombia.

Conservation status

Due to its widespread geographic distribution in habitats not conducive to agriculture or other destructive human activities, it can be assumed that *Parahancornia surrogata* is not threatened.

Recognized species of *Parahancornia*

Parahancornia Ducke, Arch. Jard. Bot. Rio de Janeiro 3: 242. 1922 (as "Parahancornea," corrected in "Errata et Corrigenda" on unnumbered page following 272). TYPE SPECIES: *Parahancornia amapa* (Huber) Ducke. Based on *Hancornia amapa* Huber, Bol. Mus. Paraense Hist. Nat. 3: 444–445. 1902. [= *Parahancornia fasciculata* (Poiret) Benoist.]

Parahancornia amara (Markgraf) Monach., Lloydia 6(4): 243. 1943 [1944]. *Couma amara* Markgraf, Notizbl. Bot. Gart. Berlin-Dahlem 11: 338. 1932. TYPE: Brazil. Amazonas: region of Manaus, *Ducke RB 22424* (holotype, B (lost)). [This species may ultimately prove to be best treated as a synonym of *Parahancornia oblonga* (Benth. ex Muell. Arg.) Monach.]

Parahancornia fasciculata (Poiret) Benoist, Arch. Bot. Mém. 5: 274. 1933. *Tabernaemontana fasciculata* Poiret, Encycl. 7: 531. 1806. *Thyrsanthus fasciculatus* (Poiret) Miers, Apocyn. S. Amer. 100. 1878; *Couma fasciculata* (Poiret) Benoist, Arch. Bot. Mém. 5: 253. 1933; *Macoubea fasciculata* (Poiret) Lemée, Fl. Guy-

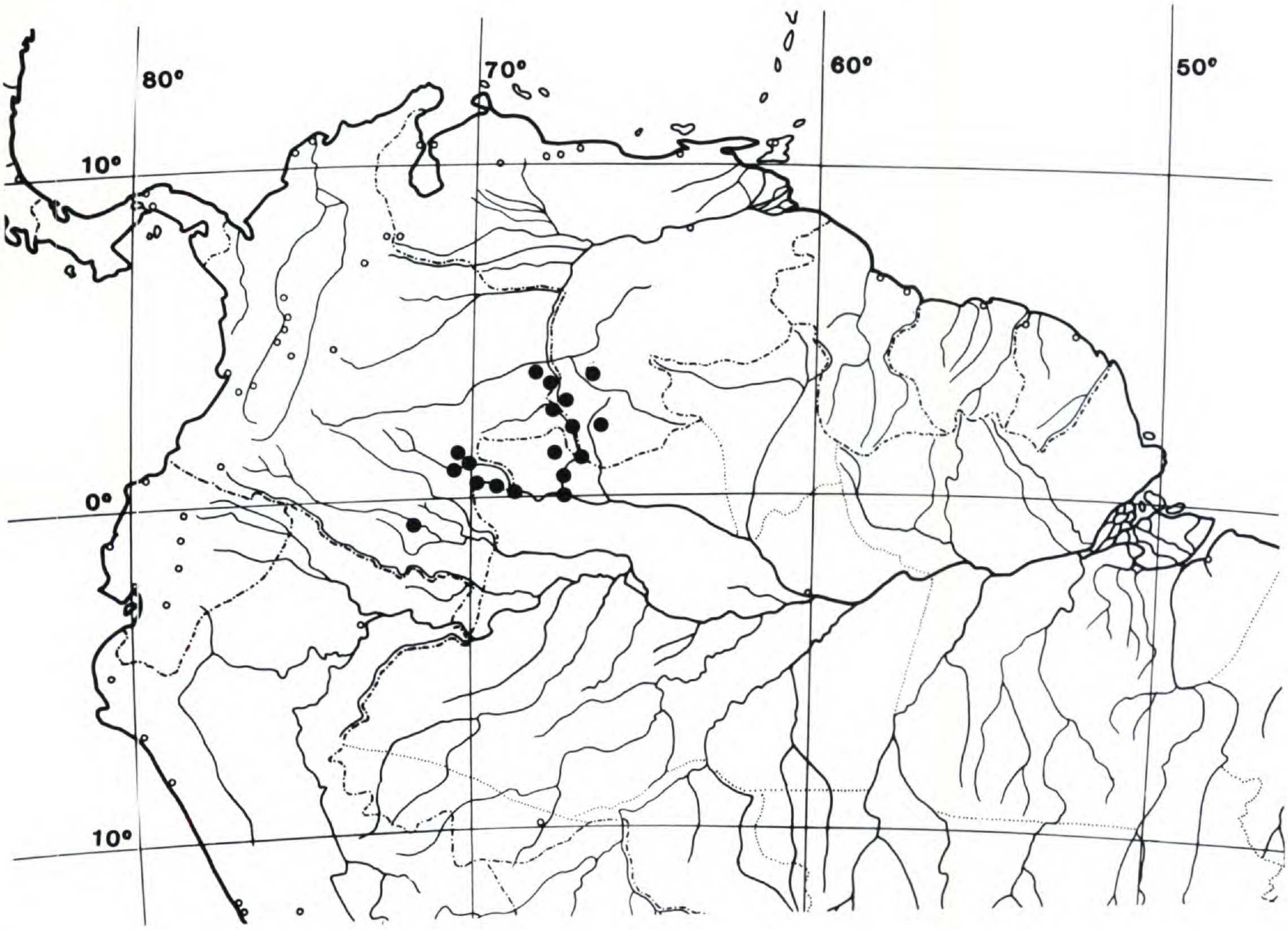

Figure 6. Known distribution of *Parahancornia surrogata* Zarucchi.

ane Fr. 3: 298. 1954. TYPE: French Guiana, *Collector unknown s.n.* (holotype, P-LAM). Central Amazonas, Pará, & Amapá, Brazil, the Guianas, and eastern Venezuela.

Malouetia lactiflua Miers, Apocyn. S. Amer. 88. 1878, syn. nov. TYPE: Guyana, *Schomburgk 168* (holotype, BM).

Hancornia amapa Huber, Bol. Mus. Paraense Hist. Nat. 3: 444–445. 1902. TYPE: Brazil, Pará, *Huber MG 1866* (holotype, MG).

Parahancornia amapa (Huber) Ducke, Arch. Jard. Bot. Rio de Janeiro 3: 242 as "*Parahancornea*," corrected on page following 272. 1922. [Benoist (1933) was the first person to equate *Tabernaemontana fasciculata* with *Parahancornia amapa*, although at first he did not recognize *Parahancornia* as meriting generic status and made the combination under *Couma*.]

Parahancornia krukovii Monach., Lloydia 6(4): 243. 1943 [1944]. TYPE: Brazil. Amazonas: *Krukoff 7189* (holotype, NY). Southwestern Amazonas, Brazil.

Parahancornia negroensis Monach., Lloydia 6(4): 244. 1943 [1944], pro parte. TYPE: Brazil. Amazonas: *Fróes 800* (holotype, NY). Eastern Colombia, southern Venezuela, and northwestern Amazonas, Brazil.

Parahancornia oblonga (Benth. ex Müll. Arg.) Monach., Lloydia 6(4): 243. 1943 [1944]. *Couma oblonga* Benth. ex Müll. Arg., Linnaea 30: 390. 1860. TYPE: border of Venezuela (Amazonas)/Colombia (Vichada): *Spruce 3619* (lectotype, selected here, BR). Eastern Colombia, southern Venezuela, northwestern Amazonas, Brazil.

Parahancornia peruviana Monach., Lloydia 6(4): 242. 1943 [1944]. TYPE: Peru. Loreto: *Klug 2979* (holotype, NY). Amazonian Peru.

Parahancornia surrogata Zarucchi [described herein]. TYPE: Colombia. Vaupés: *Zarucchi 2493* (holotype, COL). Eastern Colombia, southern Venezuela, and northwestern Amazonas, Brazil.

Excluded species

Parahancornia tabernaemontana Woodson, Bull. Torrey Bot. Club 75(5): 556. 1948. TYPE: Surinam, *Maguire 27919* (holotype, MO), syn. nov. = *Macoubea guianensis* Aublet. [This synonym under *Macoubea* was not accounted for in the publication by Allorge (1985).]

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Nomenclatural Changes and Range Extension in *Leiothrix flavescens* (Bong.) Ruhl. (Eriocaulaceae)

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The Eriocaulaceae comprise about 1,200 species distributed throughout the tropical and subtropical regions of the world (Kral, 1989). The largest number of genera and species are found in high-altitude campos of South America, especially in the Brazilian Shield (Minas Gerais and Bahia) and the Guayana Shield in Venezuela. Most species are endemic to restricted localities, often found on only one mountain or tepui summit. However, some species, such as *Leiothrix flavescens*, *Paepalanthus tortilis* (Bong.) Koern., and *Syngonanthus caulescens* (Poiret) Ruhl., occur disjunctly in both Shield areas.

A revision of the genus *Leiothrix* Ruhl., restricted exclusively to South America, is in process, with three new species recently published (Giulietti, 1988). A treatment of the genus for the *Flora of Venezuelan Guayana* is also being prepared by the junior author. *Leiothrix flavescens* is the species with the widest geographic distribution in the genus, including areas of Brazil, Venezuela, Peru, and Guyana. This fact, together with the considerable phenotypic variation, has led to the recognition of several taxa, many of which are here reduced to synonymy, and some of which are retained at the varietal level.

Leiothrix flavescens (Bong.) Ruhl., Pflanzenr. IV.30: 231. 1903. *Eriocaulon flavescens* (Bong.) Mem. Acad. Imp. Sci. St. Pétersbourg, Sér. 6, Sci. Math. 1: 628. 1831. *Paepalanthus flavescens* Koern. in C. Martius, Fl. Bras. 3(1): 423. 1863. *Dupatya flavescens* (Bong.) Kuntze, Revis. Gen. Pl. 2: 745. 1891. TYPE: Brazil. Minas Gerais: Pico Itacolomi, *Riedel 1479* (holotype, LE n.v.; isotypes, K, M, S).

Leiothrix edwallii Silveira, Fl. Serr. Min., p. 70. 1908, syn. nov. TYPE: Brazil. São Paulo: Alto da Serra de Cubatão, Estação de Campo Grande, *Edwall in hb. Silv. 429* (holotype, R).

Leiothrix affinis Silveira, Floral. Mont., vol. I, p. 286. 1928, syn. nov. TYPE: Brazil. Minas Gerais: Baraúna, *Silveira 677* (holotype, R).

Leiothrix tenuifolia Silveira, Floral. Mont., vol. I., p. 285. 1928, syn. nov. TYPE: Brazil. Minas Gerais: Baraúna, *Silveira 675* (holotype, R).

Leiothrix flavescens var. *glabra* Silveira, Floral. Mont., vol. I, p. 291. 1928, syn. nov. TYPE: Brazil. Minas Gerais: Serra do Cipó, *Michaeli in hb. Silv. 712* (holotype, R).

Leiothrix umbratilis Mold., Fieldiana, Bot. 28: 119. 1951, syn. nov. TYPE: Venezuela, Bolívar, between Ptaritepui and Sororopán-tepui, *Steyermark 60280* (holotype, NY; isotype, F).

Leiothrix flavescens var. *parvifolia* Mold., Phytologia 24: 498. 1972, syn. nov. TYPE: Brazil. Minas Gerais: Barão de Cocais, *Irwin et al. 28946* (holotype, NY n.v.; isotype, UB).

Paepalanthus meseticola Mold. & Steyerm., Bol. Soc. Venez. Ci. Nat. 32–33: 281. 1976, syn. nov. TYPE: Venezuela. Bolívar: Cerro Jaua, *Steyermark et al. 109389* (holotype, LL; isotype, MO).

Paepalanthus fraternus var. *marahuacensis* Mold., Phytologia 49: 385. 1981, syn. nov. TYPE: Venezuela. Amazonas: Cerro Marahuaca, *Maguire et al. 65609* (holotype, NY; isotype, MO).

Leiothrix flavescens var. *chimantensis* Mold., Phytologia 54: 66. 1983, syn. nov. TYPE: Venezuela. Bolívar: Chimantá Massif, Apacará-tepui, *Steyermark et al. 128382* (holotype, LL n.v.).

Stem short, or rarely up to 4 cm long. Leaves in rosettes, flat or rarely conduplicate when young, lanceolate, generally slightly falcate, 3.0–26.0 cm long, 0.2–1.5 cm wide, membranaceous, chartaceous to coriaceous, multinerved, usually pubescent on both sides, with filamentous and capitate hairs, glabrescent, rarely with filamentous hairs only, the apex obtuse to rarely acute. Peduncle sheath 3–18 cm long, pubescent with filamentous and capitate hairs, rarely filamentous only or glabrate, the apex truncate and toothed or rarely oblique. Peduncles few to many per plant, cylindrical or rarely flattened, (7.0–)25.0–70.0 cm long, twisted, obscurely 6–10-costate, pubescent with both filamentous and capitate hairs, or rarely with hairs of only one of these types, glabrescent. Capitula hemispherical to globose at maturity, 8.0–12.0 mm diam., the involucral bracts pale yellow-brown to dark red-brown, in 4–5 series, oblong-ovate to lanceolate, acute, the outermost smaller, abaxially pilose, rarely sparsely ciliate to glabrous. Floral bracts oblong-spatulate to lanceolate, acute, abaxially pilose, rarely ciliate or adaxially pilose, equaling or shorter than the flowers.

Staminate and pistillate flowers distributed in approximately concentric rings, or rarely randomly dispersed. *Staminate flowers.* Whole flower 3.0–5.4 mm long, the pedicels 1.0–2.0 mm long. Sepals 3, the two outer carinate, the inner flat, united at the base or the two outer free from each other, rarely the calyx actinomorphic, the apices rounded or truncate, rarely acute, abaxially pilose, rarely sparsely ciliate or with scattered hairs adaxially, the hairs mostly filamentous, a few capitate. Petals 3, united, obtuse, glabrous, equaling or slightly longer than the sepals. Stamens 3, free, exsert or rarely included, the filaments flat, the anthers basifixed. Pistillodes 3, united at the base, clavate. *Pistillate flowers.* Whole flower 4.0–5.4 mm long, the pedicels ca. 0.5–1.5 mm long. Sepals 3, free, carinate, actinomorphic, pubescent as in staminate flowers. Petals 3, free, flat, obtuse to acute, sparsely ciliate to glabrous at apex , equaling or slightly smaller than the sepals. Ring of hairs present at base of gynoecium. Gynoecium with styles and appendages united to the middle or above, usually 3-angled, the appendages ± cylindrical and dilated at the apex, the stigmas simple, exsert to barely included. Seeds elliptical, longitudinally striate.

Phenology: flowers in all areas throughout the year, but peak flowering varies in different localities as follows: Venezuela —January to February; Bahia—July; Minas Gerais—April to May; São Paulo and southward—November to December.

Key to the Varieties of *Leiothrix flavescens*

1a. Involucral bracts and flowers sparingly ciliate to glabrous or with scattered hairs adaxially; peduncles ± flattened; leaves and peduncle sheaths with acute apices ..... *L. flavescens* var. *polystemma*

1b. Involucral bracts and flowers pilose on abaxial surface; peduncles usually cylindrical; leaves usually obtuse, peduncle sheaths truncate at apex.

2a. Young leaves conduplicate ..... *L. flavescens* var. *distichophylla*

2b. Young leaves flat.

3a. Capitula globose; involucral bracts reflexed and hidden at maturity; peduncles about twice the length of the leaves (3.0–7.5 cm long); flowers (including pedicel) longer than 5.0 mm ..... *L. flavescens* var. *alpina*

3b. Capitula hemispherical; involucral bracts not reflexed, evident at maturity; peduncles more than three times the length of the leaves (3.0–25.0 cm long); flowers not longer than 4.0 mm ..... *L. flavescens* var. *flavescens*

Leiothrix flavescens var. **alpina** Mold., Mem. New York Bot. Gard. 9: 279. 1957. TYPE: Venezuela. Bolívar: Auyán-tepui, *Tate 1109* (holotype, NY). Figure 1A, B.

Leiothrix umbratilis var. *brevipes* Mold., Phytologia 33: 24. 1976, syn. nov. TYPE: Venezuela. Bolívar: Auyán-tepui, *Bogner 1017* (holotype, M; isotype, K).

Geographic distribution: Venezuela (Bolívar).

This variety has been collected so far only on Auyán-tepui at about 2,400 m. It is distinguished from var. *flavescens* by the length of the peduncles in relation to the leaves, by the size and random organization of the staminate and pistillate flowers, and by the globose shape of the mature capitula. Two of the three collections seen also had ten or more inflorescences, which is very rare in var. *flavescens* in Venezuela. In Venezuela and in southern and southeastern Brazil, var. *flavescens* usually has no more than five inflorescences per plant, although in Bahia and Minas Gerais, the number may be higher.

Additional specimens examined. VENEZUELA. BOLÍVAR: Auyán-tepui, *Huber 8567* (LL, NY), *Cardona 41503* (VEN).

Leiothrix flavescens var. **distichophylla** (Silveira) Giulietti & Hensold, comb. et stat. nov. *Leiothrix distichophylla* Silveira, Floral Mont., vol. I, 287. 1928. TYPE: Brazil. Minas Gerais: Diamantina, Quartel, *Silveira 412* (holotype, R). Figure 1C–E.

Geographic distribution: Brazil (Minas Gerais).

This variety has been collected only in sandy wet campos of Diamantina and Grão Mogol, where it may occur in close association with var. *flavescens.* With this variety, it shares a cespitose habit, a similar organization of flowers in the capitulum, and similar floral structure. However, it may be immediately distinguished from var. *flavescens* by the young leaves conduplicate and in a distichous ar-

→

Figure 1. *Leiothrix flavescens* (Bong.) Ruhl. and varieties. A, B. *L. flavescens* var. *alpina* Mold. (*Bogner 1017*, K).—A. Habit. —B. Pistillate flower. C–E. *L. flavescens* var. *distichophylla* (Silveira) Giulietti & Hensold (*Silveira 412*, R). —C. Staminate flower.—D, E. Pistillate flower. F–J. *L. flavescens* var. *flavescens* (F, *Riedel 1479* at K; G–J. *Giulietti et al. in CFCR 4900* at SPF). —F. Habit. —G, H. Involucral bracts, abaxial view. —I. Staminate flower. —J. Pistillate flower. K–M. *L. flavescens* var. *polystemma* (Silveira) Giulietti & Hensold (*Silveira 637*, R). —K. Involucral bract, abaxial view. —L. Staminate flower. —M. Pistillate flower.

2 cm
A
B
C
D
E
1 mm
1 mm
G
H
I
J
K
L
M
2 cm
F

rangement. This character is also found in the closely related species *L. hirsuta* (Wikström) Ruhl. and in *L. distichoclada* Herzog.

Additional specimens examined. BRAZIL. MINAS GERAIS: Grão Mogol, Serra do Pipiri, *Hatschbach 42869* (MBM, MO, SPF); Grão Mogol, near town, *Hensold et al. Coleção Flora dos Campos Rupestres* (i.e., *CFCR*) *3500* (MICH, SPF); Diamantina, estrada para Biri-Biri, *Hensold et al. CFCR 3171* (MICH, SPF); São João da Chapada, 14 km from Diamantina, *Hensold et al. CFCR 3868* (MICH, SPF); entre Serro e Datas, *Ferreira 7252* (PAMG).

Leiothrix flavescens (Bong.) Ruhl. var. *flavescens.* Figure 1F–J.

Common names (*Brazil*): *Capim manso, Capipoatinga-amarela, Gravata-manso, Sempre-viva-do-campo* (Moldenke & Smith, 1976), and *Botão-bolinha* (Diamantina, Minas Gerais).

Economic importance: In Diamantina, Minas Gerais, this variety is collected and sold as one of the "sempre-vivas" of the region. In 1984, 4,000 kg of peduncles and heads were exported for use as home decoration (Giulietti et al., 1988).

Geographic distribution: Venezuela (Amazonas, Bolívar); Guyana (vicinity of Roraima and Serra Pakaraima); Peru (Amazonas, Pasco); Brazil (Bahia, Minas Gerais, Rio de Janeiro, São Paulo, Paraná, Santa Catarina, Rio Grande do Sul). Moldenke & Smith (1976) reported this species from Goiás, but we were unable to confirm it there.

Leiothrix flavescens var. *flavescens* occurs throughout the distribution of the species. In Venezuela and Guyana, it is limited to the Guayana Shield area, where it is found in sandy wet meadows and on sandstone outcrops at 1,100–2,800 m. It is common on summits of all tepui formations in the state of Bolívar and also widespread though more sporadic to the west in Amazonas.

Noteworthy variants are found at the Cerro Marahuaca in Amazonas, and at the summit of the Chimantá Massif in Bolívar. The plants at Cerro Marahuaca, described as *Paepalanthus fraternus* var. *marahuacensis*, are distinguished by coriaceous leaves and firm involucres, which are often deep brown, glabrous, and remain firmly enclosing the head even at maturity. Peduncle lengths also tend to be irregular in this population. The Chimantá population includes the smallest known representatives of the species, some with leaves no more than 3 cm long and only 1–2 mm wide, and heads only 7–8 mm diam. These plants are described as *Leiothrix flavescens* var. *chimantensis.* However, leaf size and capitulum size are not completely correlated, and these small forms grade continuously into forms of typical size at the same locality.

In Peru the variety is known from only two collections at ca. 1,500–2,000 m. In spite of the large distance from other centers of distribution, the Peruvian material is very similar to material from Brazil and Venezuela.

In Brazil, the variety has a large geographic distribution, from Bahia to Rio Grande do Sul, where it occurs mostly in wet sandy areas in high-altitude campos at 1,000–1,800 m. In Santa Catarina and Rio Grande do Sul, it also occurs in coastal restinga, and a single collection is known from the restinga of Bahia.

The variety is most abundant, ubiquitous, and apparently competitive in the Cadeia do Espinhaço in Bahia and northern Minas Gerais. The most robust forms occur here, as well as the largest populations. In the Chapada do Couto in Minas Gerais the largest population known was observed, occupying an area of more than 6.0 m diam. Farther south in Minas Gerais, as in the Serra do Cipó and the Serra de Ibitipoca, the populations are scattered and smaller, similar to those of the Serras do Mar and Mantiqueira in Rio de Janeiro and São Paulo, and the reduction in size and frequency of the populations continues southward to the Serra Geral of Paraná and Santa Catarina, and the coastal restinga of Santa Catarina and Rio Grande do Sul. The majority of the collections examined from the Serra de Ibitipoca southward are composed of smaller individuals with a relatively dark brownish pubescence of the heads and leaves, and sometimes with leaves coriaceous, suggesting similarity with the population of Cerro Marahuaca, Venezuela.

Although it is a well-defined taxon, local differentiation between populations has led to the description of a number of superfluous taxa. *Leiothrix flavescens* var. *parvifolia* Mold. is distinguished only by smaller leaf size, a character that is very variable throughout the species. *Leiothrix flavescens* var. *glabra* Silveira is distinguished by glabrescent leaves, which, however, are pilose when young. This same pattern of variation in pubescence is observed in specimens of various localities, especially in Bahia. *Leiothrix tenuifolia* and *L. affinis* differ in no way from typical *L. flavescens. Leiothrix edwallii* Silveira is based upon a juvenile plant with small leaves and peduncles, similar to the majority of plants found in southern and southeastern Brazil.

Representative specimens examined. VENEZUELA. AMAZONAS: Cerro Yaví, *Huber 11906* (MO); Cerro Marahuaca, *Maguire et al. 65609* (MO, NY, VEN); Cerro de la Neblina, *Steyermark & Luteyn 129821* (LL, VEN). BOLÍVAR: Serranía Guanay, *Huber 11015* (MO); Cerro Jaua, *Steyermark et al. 109389* (MO); Cerro Guaiquinima, *Steyermark et al. 117345* (VEN); Cerro El Sol, NE of Auyán-tepui, *Huber 12122* (MO); Auyán-tepui, *Holst*

3804 (MO); Chimantá Massif, Apácara-tepui, *Huber & Colella 8738* (LL, VEN); Chimantá Massif, Apácara-tepui, *Huber et al. 8902* (NY); Cavanayén, *Ferrari 1080* (MY); Ptari-tepui, *Holst 3583* (MO); Ilú-tepui, *Huber 9492* (MO); Mount Roraima, *Steyermark et al. 112437* (NY, VEN). GUYANA: Mount Roraima, *Jenman 60* (US); Sierra Pakaraima, *Maguire & Fanshawe 32537* (US). PERU. AMAZONAS: Chachapoyas, *Wurdack 583* (US). PASCO: Oxapampa, *Vera 1567* (US). BRAZIL. BAHIA: Valença, *Carvalho 834* (CEPEC); Barra da Estiva, Morro do Ouro, *Giulietti et al. CFCR 1258* (K, SPF); Serra de Itubira, *Luetzelburg 276* (M, NY, R); Rio de Contas, Pico das Almas, *Harley et al. 19586* (CEPEC, IPA, K, NY, SP, SPF, UEC, US): Mucugê, estrada para Cascavel, *Harley et al. 18837* (CEPEC, IPA, K, NY, SP, SPF, UEC, US). MINAS GERAIS: *Martius 882* (K, M), *Claussen s.n.* (K, S); Grão Mogol, margem do Rio Itacambiruçu, *Hatschbach 41333* (MBM, NY, UEC); Joaquim Felício, Serra do Cabral, *Irwin et al. 27113* (F, K, MO, NY, UB, US); Milho Verde, estrada para Serro, *Hensold et al. CFCR 3740* (MICH, SPF); Santana do Riacho, Serra do Cipó, km 118, *Giulietti, Coleção Flora da Serra do Cipó* (i.e., *CFSC*) *4617* (SP, SPF); Ouro Preto, *Martius s.n.* (M); Estrada Lavras–São João del Rey, *Hensold et al. CFCR 2721* (MICH, SPF); Juiz de Fora, Serra de Ibitipoca, *Krieger & Camara 9372* (UFJF). RIO DE JANEIRO: Rio de Janeiro, Gavea, *Luetzelburg 15505* (M); Serra dos Orgãos, *Gardner 704* (BM, S, US). SÃO PAULO: São Paulo, Ipiranga, *Brade 5528* (SP, S); alto da Serra da Paranapiacaba, *Moldenke & Moldenke 19639* (S). PARANÁ: Curitiba, Higienópolis, *Hatschbach 28553* (MBM); Ponta Grossa, *Dusen 2714* (F, S). SANTA CATARINA: Palmeira, rodovia do café, *Reitz & Klein 17467* (HBR, NY, US). RIO GRANDE DO SUL: Osório, Fazenda Arroio, *Rambo 45183* (UFRS).

Leiothrix flavescens var. **polystemma** (Silveira) Giulietti & Hensold, comb. nov. *Leiothrix polystemma* Silveira, Floral. Mont., vol. I, p. 293. 1928. TYPE: Brazil. Minas Gerais: Baraúna, *Silveira 637* (holotype, R). Figure 1K–M.

Leiothrix polystemma var. *robusta* Silveira, Floral. Mont., vol. I, p. 294. 1928, syn. nov. TYPE: Brazil. Paraná: Margens secas do rio Piraí, *Michaeli s.n.* (holotype, R).

Geographic distribution: Brazil (Minas Gerais, Paraná).

This variety is similar to var. *flavescens* with respect to habit and concentric organization of the staminate and pistillate flowers in the capitulum. It is characterized by the glabrescent leaves, which lack capitate hairs, by the acute apices of the leaves and peduncle sheaths, and especially by the involucral bracts sparingly ciliate to glabrous, and by the floral bracts and sepals with scattered cilia and sometimes with scattered hairs on the adaxial surface, but never pilose abaxially as in var. *flavescens*.

Additional specimen examined. BRAZIL. MINAS GERAIS: Diamantina, *Giulietti 959* (SPF).

We thank the curators of CEPEC, F, HBR, IPA, K, LL, M, MICH, MO, MY, PAMG, R, S, SP, SPF, UB, UEC, UFJF, UFRS, US, and VEN for the loan of specimens. The work was completed while the senior author was a visiting research scientist under the Missouri Botanical Garden Postgraduate Fellowship Program, supported by the Jessie Smith Noyes Foundation.

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Rudgea monofructus (Rubiaceae), an Unusual New Species from Costa Rica

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Rudgea Salisbury is a genus of about 150 species of shrubs and small trees found in wet forests of the Neotropics. The majority of species are known from South America. This genus is allied to *Psychotria*, from which it is separated primarily by its pectinate or fimbriate appendages on the stipules. These appendages appear to be a reliable character but are frequently caducous, making the identification of this genus difficult when young stipules are not well preserved.

Rudgea monofructus Gómez-Laurito & Dwyer, sp. nov. TYPE: Costa Rica. Alajuela: Reserva Forestal de San Ramón, campamento Río San Lorencito, 10°13′N, 84°37′W, 900–1,100 m, 2 Sep. 1989, *J. Gómez-Laurito & G. Vargas 11822* (holotype, CR; isotypes, F, USJ). Figure 1.

Frutex vel arbuscula ad 4 m altus omnino glaber ramosus. Folia opposita, lamina lanceolata usque elliptica vel oblanceolata, 7–18 cm longa, 2–9 cm lata, apice acuminata, base angustata usque cuneata, paribus nervorum secundariorum ca. 4–10 regulariter arcuatis, infra elevatis, certeris conspicue reticulatis; petiolis 3–12 mm longis, ca. 2 mm crassis; stipulis succulentis cupuliformibus, deciduis, lingulatis vel ellipticis, 3–10 mm longis, ad apicem fimbriatis fimbriis 0.5 mm longis. Flores solitarii (–3), terminali, odore *Gardenia* praediti; pedunculis teretibus, 1.5–4 mm longis, ad apicem articulatis, ca. 1 mm crassis; pedicellis 0–28 mm longis, ca. 1 mm crassis, ad apicem articulatis; calyx cupuliformis, 3–13 mm longis, ca. 6 mm diametro, albus, 3–4-lobulatus, lobulis 3–5 mm longis, in fructus persistentibus; corolla alba, salverformis, tubo 5–9 mm longo, 5 mm diametra, lobulis 6, 8–11 mm longis, 2–3 mm crassis, trigonis, carnosis, in tubum gradatim decrescentibus, lobulo calcaris perfecte incurvato apice angusto; stamina 7 in tubo pro parte tertia adnata, filamentis planis, 1 mm longis; antherae anguste oblongae, ca. 3.5 mm longae, basifixae, apiculatae, apiculo 0.4 mm longo; stylus rectus, 11 mm longus, leviter exsertus. Fructus pallido-viridis, demum albus, 1.2–2 cm longus, 10–14 mm diametro.

Shrubs or small trees to 4 m tall, glabrous throughout. *Leaves* opposite, decussate; blades lanceolate to elliptic or oblanceolate, 7–18 cm long, 2–9 cm wide, acuminate at apex with the tip to 1 cm long, acute to cuneate at base, chartaceous, glabrous; secondary veins 4–10 pairs, arcuate, prominulous below, the lesser venation reticulate and rather pronounced below as well; petioles 3–12 mm long, ca. 2 mm thick; stipules persistent only on uppermost 1–3 nodes, succulent, lingulate to elliptic, cupuliform, 3–10 mm long, rounded to truncate, fimbriate at the very apex with 3–10 projections ca. 0.5 mm long, these deciduous. *Flowers* 1(–3), terminal, with odor of *Gardenia;* peduncles terete, ca. 1 mm thick, articulated at apex, 1.5–4 cm long; pedicels similar, 0–28 mm long; calyx limb cupuliform, 3–13 mm long, ca. 6 mm diam., white, irregularly 3–4-lobed, the lobes 3–5 mm long, subtruncate to rounded, persistent in fruit; corolla carnose, white, salverform, the tube 5–9 mm long, the lobes 6, narrowly triangular, trigonal, 8–11 mm long, 2–3 mm thick, at apex acute and appendaged, the appendages incurved, narrowly triangular, 3–4 mm long, acute; stamens 7, inserted in the lower ⅓ of the tube, filaments flattened, ca. 1 mm long, anthers narrowly oblong, ca. 3.5 mm long, basifixed, apiculate with the appendage ca. 0.4 mm long, triangular, acute. Style ca. 11 mm long, straight, filiform; stigma subcapitate, ca. 0.5 mm long. *Fruit* ovoid, smooth, succulent, pale green becoming white, 12–20 mm long, 10–14 mm diam.

Located in wet forests at 600–1,200 m in the southern Cordillera de Tilarán of Costa Rica northward to Volcán Miravalles. Collected in flower July to September and in November; in fruit February, June, August, and October to November.

This new species is unusual in *Rudgea* because of several characters: its 6-merous corollas with appendaged lobes longer than the tube, vs. 4–5-merous corollas with the tube longer than the unappendaged lobes in most other species; its usually solitary or rarely three flowers, in contrast to five or usually more flowers in pyramidal inflorescences in most other species; and its seven stamens, in contrast to four or five in most other species. This new species is most similar to the sympatric *R.*

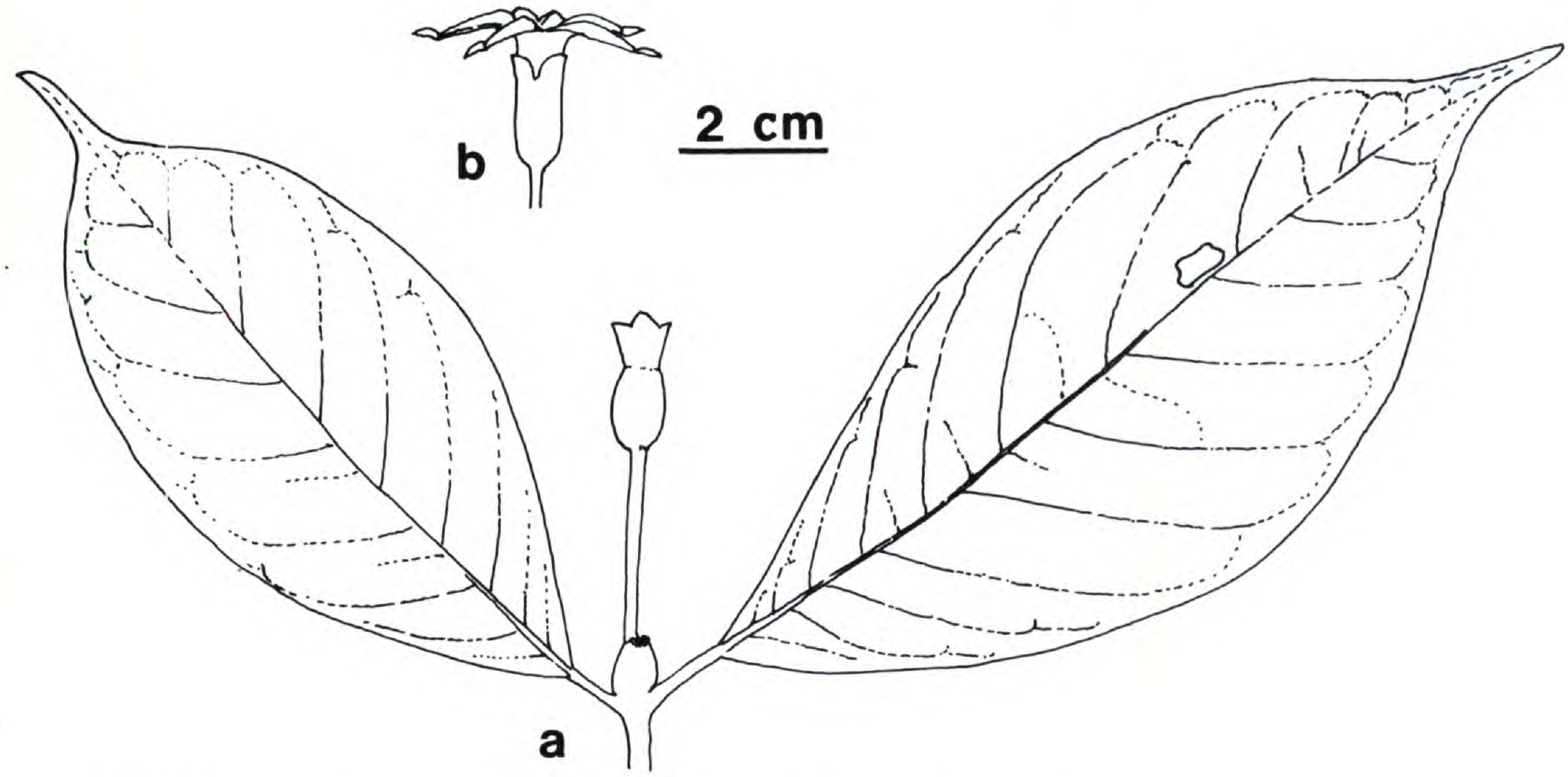

Figure 1. *Rudgea monofructus* (*E. Bello 539*, MO). —a. Habit with fruit. —b. Flower.

skutchii Standley, which is found at 50 to 1,200 m in wet forests from Colombia north to the Monteverde area in Costa Rica. *Rudgea skutchii* also has appendaged corolla lobes longer than the tubes, but it is easily separated by its 5-merous corollas with lobes 6–8 mm long, inflorescences with 5–15 flowers, and shortly truncate to rounded or cordate leaf blades borne on petioles 0–6 mm long.

Paratypes. COSTA RICA. ALAJUELA: Reserva Biológica de Monteverde, Río Peñas Blancas, Vertiente Atlántica, 10°19′N, 84°43′W, *E. Bello 365* (CR, MO); Reserva Biológica de Monteverde, Río Peñas Blancas, Quebrada Azufre, 10°19′N, 84°42′W, *E. Bello 539* (CR, MO, USJ); between San Lorenzo and Los Angeles de San Ramón, above Río San Lorenzo, 10°14′N, 84°32′W, *W. Burger & T. Antonio 11193* (F); Reserva Forestal de San Ramón, campamento Río San Lorencito, 10°13′N, 84°37′W, *I. Chacón et al. 2174* (CR), *P. Döbbeler & J. Gómez-Laurito s.n.* (M, USJ), *J. Gómez-Laurito et al. 12000* (CR, F, USJ); faldas del Miravalles, Zapote, Upala, *J. Gómez-Laurito 9314* (F); Reserva Forestal de San Ramón, ca. Colonia Palmareña, *J. Gómez-Laurito 10571* (F); Reserva Forestal de San Ramón, campamento Río San Lorencito, 10°13′N, 84°37′W, *J. Gómez-Laurito 11741* (F); Reserva Biológica de Monteverde, Laguna de Peñas Blancas, vertiente Atlántica, 10°18′N, 84°43′W, *W. Haber & E. Bello 7415* (CR, MO); Reserva Biológica de Monteverde, Río Peñas Blancas, 10°18′N, 84°44′W, *W. Haber & E. Bello 7937* (CR, MO); Río Peñas Blancas, San Carlos, *W. Haber & E. Bello 2312* (CR, MO); La Fortuna de San Carlos, 3 km al sur del Cerro Chato, junto al Río Fortuna, 10°25′20″N, 84°41′40″W, *Q. Jiménez & L. H. Elizondo 734* (CR, MO, USJ); near La Laguna, 6–8 km S of Villa Quesada, *A. Molina et al. 17550* (F); San Ramón, Las Cataratas, *L. J. Poveda 763* (CR, USJ).

We thank the curators of CR, F, and MO for providing specimens for examination, and R. E. Gereau for critical comments on the manuscript.

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NOVON

A New Species of *Calomnion* (Bryopsida) from Lord Howe Island

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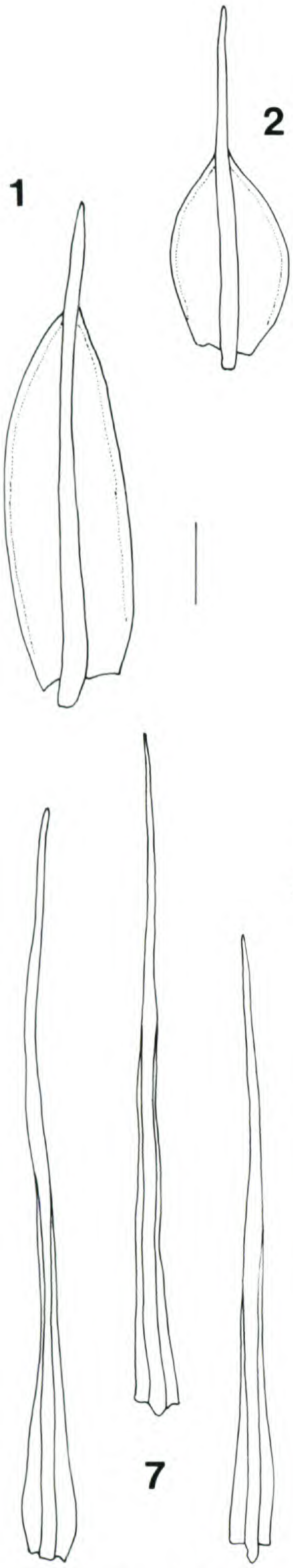
Calomnion is small genus of mosses of about a half dozen species that is restricted to the South Pacific and Australasia. *Calomnion complanatum* (Hook. f. & Wils.) Lindb. (= *C. laetum* Hook. f. & Wils., illegitimate, earlier species included) is reported from New Zealand and Australia, *C. denticulatum* Mitt. is known from Samoa, *C. schistostegiellum* (Besch.) Wijk & Marg. is known from the Society Islands, and *C. melanesicum* H. A. Miller has recently been described from Vanuatu and Fiji. The genus is defined by the following features: simple stems with terminal sex organs (acrocarpy), dimorphic leaves in three ranks, highly differentiated perichaetial leaves, erect capsules, and the complete absence of a peristome. From *Rhizogonium* sensu stricto, with which it shares many characters, it is distinguished by erect capsules and lack of a peristome. The leaves never possess a margin defined by a border of elongate cells as do some species of *Rhizogonium*. Species of *Calomnion* are found almost exclusively on tree fern trunks that are heavily matted with adventitious roots.

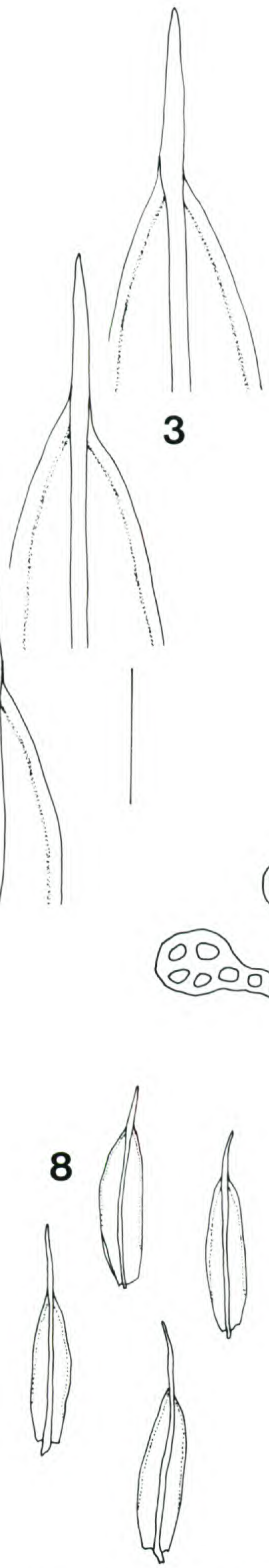
During 1981, collections of bryophytes from Lord Howe Island (31°30′S, 159°05′E) made by Helen Ramsay and myself included several specimens that represent a new species of *Calomnion*, here described as new to science.

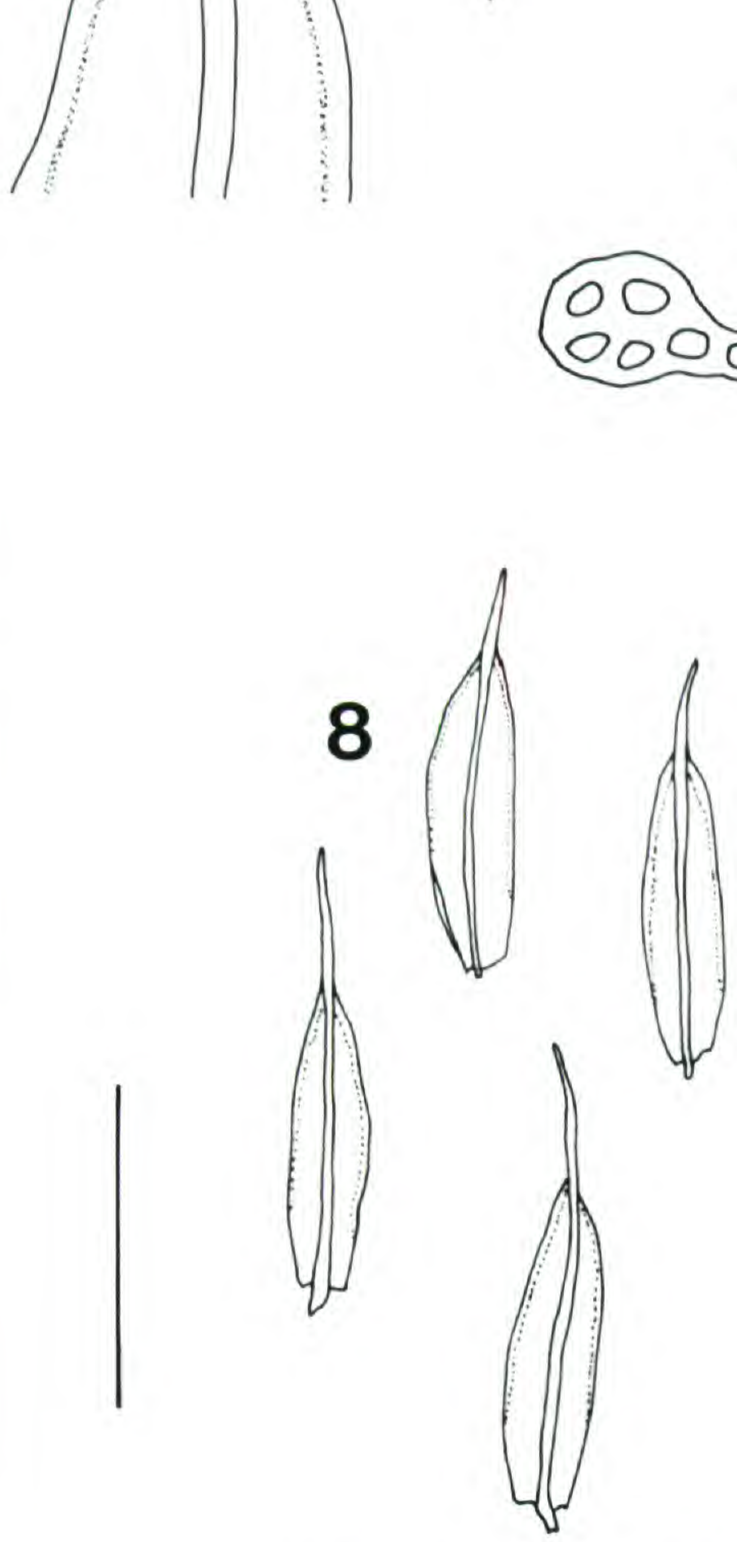
Calomnion milleri Vitt, sp. nov. TYPE: Lord Howe Island. E slope of Mt. Lidgbird, SE of Goat House Cave on montane slope, 21 Nov. 1981, *Vitt 28739* (holotype, ALTA; isotypes, NY, NSW). Figures 1–11.

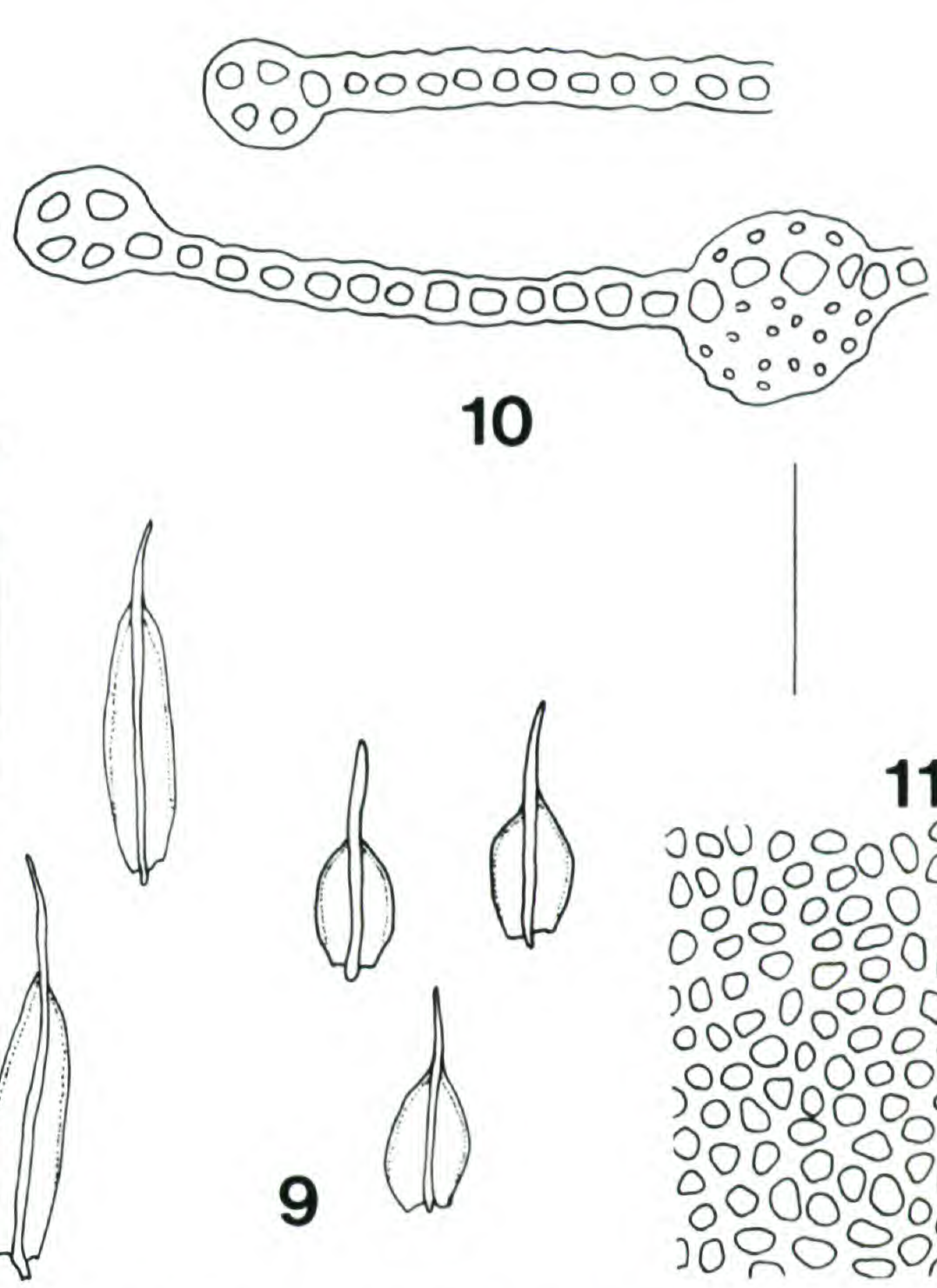
Plantae aureo-virides, ad 1.0 cm altae. Folia dimorpha, oblonga, acuminata, aristata, margine incrassata, integra; costa excurrente; cellulae superiores 6–8 μm latae, rotundo-quadratae, laeves. Perichaetia terminalia; folia 4.0–5.0 mm longa, flexuosa subulata; costa longe excurrente. Flores dioici. Setae 0.8–1.0 mm longae. Capsulae 1.2–1.4 mm longae, cylindricae, erectae, laeves, immersae. Peristomium nullum. Calyptrae cucullatae.

Plants small, delicate, up to 1.0 cm long, shiny, golden green, in dense mats on tree fern trunks. Stems erect from persistent protonemata, simple, terminated by perigonia or perichaetia. Leaves along proximal region of stems small, lanceolate, acuminate, monomorphic, loosely erect-spreading; leaves along distal portions of stems larger, dimorphic, in three distinct ranks; dorsal ranks of leaves somewhat erect-falcate to erect-deflexed when dry, erect when moist, 1.1–1.3 mm long, oblong to narrowly ovate-oblong, acuminate, stoutly aristate, ventral rank of leaves erect when dry, 0.7–0.8 mm long, ovate to obovate, acuminate, cuspidate; margins entire, thickened and appearing revolute; costa strong, single, excurrent and filling the arista or cusp; upper cells 6–8 μm wide, rounded-quadrate, thick-walled, smooth, unistratose except at margins, there the marginal 2–4 rows distinctly bistratose forming a strongly differentiated border; basal cells rounded-quadrate to shortly elliptic-rectangular, thick-walled, smooth; alar cells undifferentiated. Perichaetial leaves loosely erect, strongly differentiated from vegetative leaves, 4.0–5.0 mm long, linear to linear-lanceolate, subulate to long-acuminate; perigonial leaves loosely erect, strongly differentiated from vegetative leaves, 2.1–2.3 mm long, subulate from an ovate, sheathing, expanded base. Dioicous. Setae 0.8–1.0 mm long, erect, smooth; capsules 1.2–1.4 mm long, cylindric, smooth, erect, immersed, sometimes slightly wider in lower portion; exothecial cells 12–25 μm wide, 18–50 μm long, rounded-rectangular









Figures 1–11. *Calomnion milleri* Vitt. —1. Dorsal leaf. —2. Ventral leaf. —3. Dorsal leaf apices. —4. Capsules. —5. Calyptra. —6. Operculum. —7. Perichaetial leaves. —8. Dorsal leaves. —9. Ventral leaves. —10. Transerve sections of upper portions of dorsal leaves. —11. Upper cells of dorsal leaves. Scale bar for Figures 1–3 = 0.2 mm; 4–9 = 1.0 mm; 10–11 = 50 fm. Drawn from the holotype.

to quadrate, becoming shorter and reddish at rim; stomates superficial, at base of capsule. Peristome none. Annuli of one row of short-elliptic cells. Opercula conic, long rostrate. Calyptrae short, cucullate, with a scabrous beak. Spores 12–16 μm, finely papillose. Chromosome number $n = 6$ (Helen Ramsay, pers. comm., voucher specimen—*Vitt 28393*).

Paratypes. LORD HOWE ISLAND. E slope of Mt. Lidgbird, SE of Goat House Cave on montane slope, 21 Nov. 1981, *Vitt 28729* (ALTA, NY, CHR), *28732* (ALTA, MO); 16 Nov. 1981, *Vitt 28393* (ALTA), *28394* (ALTA, H), *28395* (ALTA, FH, S, DUKE); summit of Mt. Gower, 17 Nov. 1981, *Vitt 28460* (ALTA, MO, NSW), *28532* (ALTA).

The eight specimens reported from Lord Howe Island were collected from roots matting the trucks of tree ferns in upper montane, subtropical rainforest between 450 and 875 m. The surrounding subtropical forest is dominated by *Metrosideros nervulosa*, *Dracophyllum fitzgeraldii*, and *Cyathea* spp.

I have seen material of this species only from Lord Howe Island. A specimen from Norfolk Island (*Streimann 34569*, CBG) containing only female plants clearly refers to another taxon.

This species is distinguished from species of *Rhizogonium* by erect, immersed capsules and complete lack of a peristome. *Hymenodon* possesses mammillose leaf cells and piliferous leaves. From the remaining species of *Calomnion*, *C. milleri* is distinguished by bistratose and thickened leaf margins, immersed capsules on setae that are shorter than the capsules, and by the long, slenderly acuminate, subulate perichaetial leaves.

Calomnion milleri is named in honor of Harvey Alfred Miller, a good friend, whose research on the bryoflora of the Pacific Islands has greatly increased our knowledge of these plants.

Acknowledgments. Fieldwork on Lord Howe Island was supported through a travel grant from the Natural Sciences and Engineering Research Council of Canada and through grant A-6390, for which I am grateful. Helen Ramsay (Macquarie University, Sydney) allowed me to report her unpublished chromosome count of *C. milleri*, based on my collection from Lord Howe Island, and Heinar Streimann (Australian National Botanic Gardens, Canberra) kindly made his specimen from Norfolk Island available to me.

A New Species of *Debregeasia* (Urticaceae–Boehmerieae) from Asia and a New Record of *D. wallichiana* for China

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Debregeasia Gaudich., a member of the subtribe Oreocnidinae C. J. Chen of the tribe Boehmerieae (Chen, 1983), consists of six species instead of four that were reported by Wilmot-Dear (1988). The present paper describes a new species, *D. orientalis* C. J. Chen, from eastern Asia and reports *D. wallichiana* as new for China.

Debregeasia orientalis C. J. Chen, sp. nov. TYPE: China. Southeastern Sichuan: Nanchuan Co., Sanquan, Longguxi, 550 m, along streams, 27 Mar. 1957, *G. F. Li 60238* (holotype, PE; isotype, SZ).

Debregeasia longifoliae affinis, a qua imprimis differt florescentia coaetanea vel praecoce in vere, inflorescentiis e ramulis vetioribus praecedentibus, foliis angustioribus petiolis brevioribus, pubescentia ex trichomatibus plerumque brevioribus adpressisque constante.

Dioecious shrub 1–2.5 m tall. Branches sparsely to densely pubescent with short, usually appressed, fine trichomes. Leaves lanceolate to linear-lanceolate, 6–15(–24) × (0.6–)1.2–4.7(–5.2) cm, acuminate at apex, rounded or slightly cuneate at base, usually very finely serrulate, sparsely pubescent or glabrous adaxially, gray tomentose between veins abaxially, the lateral veins 4–7 on each side; petioles 0.5–1.5(–2.4) cm, with pubescence similar to that of branches; stipules oblong-ovate, 0.5–0.8 mm, bifid at apex. Inflorescences 0.6–1.5 cm, axillary, once or twice dichotomously branched, pedunculate or rarely subsessile, the rachis with pubescence similar to that of branches. Flowers in dense globose clusters; male flowers 3–5 mm diam., 4-merous; female flowers 1.5–2.0 mm diam., subtended by triangular to obovate bracts 0.2–0.6 mm long, the perianth tubular, succulent. Fruit ovoid, slightly compressed, 0.2–0.6 mm long, with persistent, orange, fleshy perianth.

Debregeasia orientalis is distributed in Japan, eastern and southern China, northeastern India, Bhutan, and Nepal; it grows in wet places of mountains, especially along streams, rivers, ditches, lakes, ponds, and well-watered mountainsides at altitudes of 500 to 3,500 m; flowering February through May; fruiting June into October.

Paratypes. JAPAN. HONSHU: Hyogoken, *Murata & Nishimura 67706* (GH); Mt. Kiyosumi, *Nakaike 15527* (MO). KYUSHU: Kagoshima Pref., *Deguehi 4747, 6599* (GH). SHIKOKU: Ehime Pref., *Murata 15080* (GH). RYKYU ISLAND: Okinawa, *Wilson 8103* (GH). CHINA. TAIWAN: Taipei, *Huang 2435* (GH, MO); Taihoku, 24 Mar. 1929, *Sasaki s.n.* (GH); Hualian Co., *Lai et al. 13313, 13314* (GH); Taichung Co., Lishan, *Kuo 51131* (MO). SHAANXI: Ankang, *Liou 8271* (PE). GANSU: SE Gansu, *Wang 80044* (PE). GUANGXI: Lingyuan Co., *Steward & Cheo 408* (GH). HUNAN: Yuanling Co., *Liu 56* (GH). HUBEI: Ichang Co., *Henry 1201* (GH, K); Badong Co., *Chow 620* (PE); Xingshan Co., *Jiang et al. 217* (GH). SICHUAN: Chengkou Co., *Dai 1000105, 1000198, 1000227, 1000439* (PE, SZ); Wuxi Co., *Yang 58263* (PE, SZ); Chongqi Shi, Jinyun Shan, *Huang 1008* (PE); Pingwu Co., *Tsiang 10083* (PE); Kuan Xian Co., *Wu 33778* (PE); Leshan Co., *Chen et al. 139* (PE, KUN); Emei Mt., *Fang 13936* (PE, SZ); Pingshan Co., *Wang 22708* (PE); Puge Co., *Guan 6098, 9286* (PE); Hongya Co., *Yiao 2053* (PE); Simian Co., *Hsien 40577, 40664* (PE, SZ); Xican Co., *Yu 1118* (PE); Tianquan Co., *Yu 1821* (PE); Baoxing Co., *Kuan et al. 2526* (PE); Kangdiang Co., *Chow 9031, 9513* (GH); Jiulong Co., *Wang 4527* (PE, SZ); Muli Co., *Feng 2851* (KUN, PE). GUIZHOU: Zhang'an Co., *Tsoong 349* (PE); Shiyang Co., *Tsoong 421* (PE); Tongzi Co., *Tsiang 4952* (GH, PE); Pingbai Co., *Tsoong 1252* (PE). YUNNAN: Dongchuan Co., *Lang 277* (PE); Shungming Co., *Yu 16495* (PE); Kunming Shi, *Chen 218* (PE); Guangnan Co., *Wang 87215, 87323* (PE); Kaiyuan Co., *Tsai 53016, 53112* (KUN, PE); Mengzi Co., *Henry 600, 10356* (MO); Dali Co., *Ching 22910* (PE); Pingbian Co., *Tsai 62235* (PE); Jingdong Co., *Xu 59-4404* (PE); Zhengkaing Co., *Wang 72416* (PE); Lijiang Co., *He 20145* (PE); Zhongdian Co., *Feng 1057* (KUN, PE); Weixi Co., *Wang 63571* (GH, PE), *Wang 64253* (PE); Gongshan Co., *Yu 8386* (PE). XIZANG (TIBET): Tangmai, *Ying & Hong 99, 776* (PE). INDIA. Kumaon, *Strachey et al. 12* (GH, K); Rejhur, 10 Oct. 1904, *Hole s.n.* (GH). BHUTAN. Khagra valley near Kokti Samchi distinct, *Grierson & Long 3403* (GH). NEPAL. Tusare, *Grierson & Long 3040* (GH); 22 km S of Chimakothi between Phuntsholing and Thimphu, *Bartholomew & Boufford 3978* (GH).

Debregeasia orientalis is widespread in the eastern Asian temperate and subtropical zones, and its common Chinese name is "shuima." Many authors (e.g., Weddell, 1869; Hooker, 1888; Sargent, 1916; Hara, 1966) misidentified the species as *D. edulis*, but as Wilmot-Dear (1988) clearly pointed out, the type of the latter should be referred to the genus *Oreocnide* Miq. Wilmot-Dear did not describe this entity as a new taxon of *Debregeasia*. Instead, she

referred it to *D. longifolia*, which she considered to show considerable variation in some characters, most notably leaf shape and indumentum. The new species is distinct from *D. longifolia* and is readily distinguished in having narrower leaves, shorter petioles, and appressed pubescence. Furthermore, ranges of the two species hardly overlap; *Debregeasia orientalis* is distributed in Japan, eastern and southern China, northern India, Bhutan, and Nepal, whereas *D. longifolia* grows in southwestern China, India, Bangladesh, Sri Lanka, Indonesia, the Philippines, and Indochina.

Debregeasia orientalis and *D. longifolia* are largely reproductively isolated in these areas, and they occur at different altitudes and bloom in different seasons. While *D. longifolia* blooms in late summer and autumn, the flowers of *D. orientalis* appear only in spring before or with the new leaves. The branches of *D. orientalis* have no inflorescences on the new year's growth, while those of *D. longifolia* bear inflorescences to the tips. These differences have not been previously noted.

Debregeasia wallichiana (Wedd.) Wedd., which is distributed in Nepal, Sikkim, Bhutan, eastern Bangladesh, India (western Ghats and northeastern India), Sri Lanka, northern Burma, Thailand, and Cambodia, is reported here for the first time from China. The new record is based on the following collection: China. Yunnan: Yiwu, Mengla Co., Xishuangbana District (21°44′N, 101°34′E), 800 m, limestone woods, 12 July 1978, *J. H. Zhang 19252* (GH). This locality represents the northeasternmost limit of the species.

Debregeasia orientalis and *D. wallichiana* are distinguished from the remaining species in the genus by the following key.

Key to the species of *Debregeasia*

1a. Leaves broadly ovate, elliptic, or cordate; fruiting perianth membranaceous.
  2a. Leaves usually elliptic; branches without leaf scars, spreading hirtellose .... *D. elliptica* C. J. Chen
2b. Leaves broadly ovate or cordate; branches with leaf scars, appressed pubescent.
  3a. Branches with fleshy, scalelike protuberances or warts; inflorescences to 3 cm; leaf secondary veins in 3–5 pairs ..... *D. squamata* King ex Hook. f.
  3b. Branches without protuberances or warts; inflorescences more than 5 cm; leaf secondary veins in 5–8 pairs .. .. *D. wallichiana* (Wedd.) Wedd.
1b. Leaves lanceolate, sometimes narrowly ovate or oblong; fruiting perianth succulent.
  4a. Branches spreading pubescent; at least some inflorescences on present year's branches; flowering August to December .... *D. longifolia* (Burm. f.) Wedd.
  4b. Branches usually appressed pubescent; all inflorescences on branches of previous seasons; flowering February through May.
    5a. Leaves densely white tomentose beneath, fine veins invisible; inflorescences sessile .... *D. saeneb* (Forssk.) Heppe & Wood
    5b. Leaves gray tomentose beneath, fine veins visible; inflorescences usually pedunculate ..... *D. orientalis* C. J. Chen

Acknowledgments. I am grateful to Billie L. Turner and Steve Ginzbarg (TEX), as well as to Ihsan Al-Shehbaz (MO), for comments on the manuscript and to W. T. Wang (PE) for confirming the necessity of this new species. The initial research was undertaken at the Institute of Botany, Academia Sinica, Beijing, under the National Natural Science Foundation of China, with additional support from the May Scholarship Fund. Thanks are also due to Peter H. Raven and William Tai (MO) for their kind encouragement and advice, and to David Boufford (GH), Guy Nesom (TEX), James C. Solomon (MO), C. M. Wilmot-Dear (K), and X. Y. Zhu (PE) for help during the work.

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A New Variety and New Varietal Combinations in Chinese Verbenaceae

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During preparation of the treatment of Verbenaceae for the *Flora of China*, it became evident that the nomenclature of several infraspecific taxa in various genera needed adjustment. I propose the following novelties in order to make these names available for this and other Chinese floristic works now in progress. A new variety and three new varietal combinations in *Callicarpa* and one new combination each in *Vitex* and *Clerodendrum* are proposed.

Callicarpa

Callicarpa prolifera C. Y. Wu var. **rubroglandulosa** S. L. Chen, var. nov. TYPE: China. Northern Guangxi: Da-Miao Shan, 890 m, *X. Q. Chen 14461* (holotype, IBSC).

A varietate prolifera foliorum laminis anguste lanceolatis, (6–)12–16(–19) × (1–)2–4 cm, basi decursivis subsessilibus, utrinque subglabris, ad paginam inferiorem rubroglandulosis; calycibus, corollis et staminibus dense rubroglandulosis differt.

Paratype. CHINA. Northern Guangxi: Da-Miao Shan, *H. Lu 2783* (IBSC).

Callicarpa prolifera var. *rubroglandulosa* is readily distinguished from the type variety by its narrower leaves and by the dense reddish brown glands on the lower leaf surfaces, calyces, corollas, and stamens.

Callicarpa integerrima Champion var. **chinensis** (Pei) S. L. Chen, comb. nov. Basionym: *C. formosana* Rolfe var. *chinensis* Pei, Mem. Sci. Soc. China 1(3): 30. 1932; *C. pedunculata* R. Br. var. *chinensis* (Pei) Metcalf, Lingn. Sci. J. 11: 405. 1932. TYPE: China. Guangdong: Changkiang to Chengkou, Dec. 1927, *Chun 5828* (syntypes, UC n.v., A).

In *Callicarpa integerrima* var. *chinensis* the leaves, pedicels, calyces, corollas, and ovaries are glabrous, or the leaves are pubescent only when young. In contrast, in var. *integerrima* the leaf blades are yellow-brown, stellate tomentose adaxially and gray-yellow, densely tomentose abaxially, and the pedicels, calyces, and ovaries are stellate tomentose.

Callicarpa giraldii Hesse ex Rehder var. **chinyunensis** (Pei & W. Z. Fang) S. L. Chen, comb. nov. Basionym: *C. chinyunensis* Pei & W. Z. Fang, Fl. Reipubl. Popul. Sin. 65(1): 209. 1982. TYPE: China. Sichuan: Beibei, Jinyun Shan, *S. J. Wang 1109* (holotype, NAS).

This variety differs from the other two of *Callicarpa giraldii* by its purple-brown branchlets with distinct lenticels, its denser cymes, and its leaves with obtuse or rounded base, gray-brown, densely stellate lower surface, and hispidulous-scabrous upper surface.

Callicarpa longipes Dunn var. **mixiensis** (Z. X. Yu) S. L. Chen, comb. nov. Basionym: *C. mixiensis* Z. X. Yu, J. Jiangxi Agr. Univ. 1: 1. 1982. TYPE: China. Jiangxi: Ruijin Xian, Mixi, *Z. X. Yu 1315* (holotype, Herb. Forest Dep. Jiangxi Agr. Univ.).

Callicarpa longipes var. *mixiensis* is easily distinguished from the type variety in having whitish fruits and leaves that are yellow-glandular on both surfaces. Variety *longipes* has purple fruits and pilose leaves that are yellow-glandular abaxially.

Vitex

Vitex trifolia L. var. **taihangensis** (L. B. Guo & S. Q. Zhou) S. L. Chen, comb. nov. Basionym: *V. taihangensis* L. B. Guo & S. Q. Zhou, Bull. Bot. Res. 9(4): 61. 1989. TYPE: China. Shanxi: Tai Hang Shan, 1,400 m, 15 Aug. 1986, *Guo Lan-bin 688* (holotype, NMFC).

Characters that separate var. *taihangensis* from the type variety are the presence of simple instead of trifoliolate leaves, and glabrous, eglandular, instead of glandular, ovaries.

Clerodendrum

Clerodendrum chinense (Osbeck) Mabberley var. **simplex** (Moldenke) S. L. Chen, comb. nov. Basionym: *C. philippinum* Schauer var. *simplex* Moldenke, Phytologia 20: 338. 1970. TYPE: Thailand. Ban Musseo: between Tak

and Mae Sot, 400 m, 21 July 1959, *F. Floto 7634* (holotype, Moldenke Personal Herb. (Plainfield, New Jersey n.v.).

Variety *simplex* is readily distinguished from the type variety in having single instead of double flowers. It grows in forests and along streams in Guangxi, Guizhou, and Yunnan, whereas var. *chinense* is cultivated in Yunnan, Guangxi, Guandong, Fujian, and Taiwan, as well as in other parts of tropical and subtropical Asia.

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A New Species of *Hydrophyllum* from the Ouachita Mountains of Arkansas

Robert Kral and Vernon Bates

Herbarium, Department of Biology Vanderbilt University, Box 1705, Station B, Nashville, Tennessee 37235, U.S.A.; P.O. Box 1473, Mena, Arkansas 71953, U.S.A.

In early May of 1979, during some fieldwork in the Ouachita Mountains in southwestern Arkansas, a small population of a *Hydrophyllum* was found on rocky, hardwood-forested bluffs along the Cossatot River (Howard County, 8 May 1979, *R. Kral 63510*). This was recorded and later again determined to be *H. macrophyllum* Nuttall. Checking the descriptions, statements on ecology, and distribution given in recent revisional work by Constance (1942) and Beckmann (1976, 1979) appeared to confirm the identification of the plant as *H. macrophyllum*, a species of the Central Plains and Appalachian provinces. Statements of range for *H. macrophyllum* as given by these two authors differ slightly, both showing a distribution of this mesophyte from the Central Lowlands of Illinois, Indiana, Ohio, southward through the Appalachians to western North Carolina in the east, and with western limits from southern Illinois southward through Kentucky, central Tennessee, and northern Alabama. However, Beckmann, in his citations of specimens, indicated an Arkansas record (1976: 366), "Arkansas. Montgomery Co.–Albert: rich woods, *Demaree 36687* (GH)," the "Albert" given there ostensibly representing the Albert Pike Recreation Area or its vicinity in the Ouachita National Forest. Nonetheless, the Howard County find was thought to be a recent and unpublished record for Arkansas, and a check of Smith's (1978) atlas was made. According to Smith, the species had been reported for Arkansas by Dwight Moore as early as 1951, and there were currently five counties known for it. Thus the investigation ended, the Howard County specimen was routinely filed at the Vanderbilt University Herbarium (VDB), and the matter was forgotten.

Several years later, in 1988, another *Hydrophyllum* specimen from the Arkansas Ouachitas was brought in for determination (*Bates 7557*). This unicate was an eye-opener, particularly because, unlike the "top-snatched" Kral material, it had an intact rootstock containing a dense fascicle of small, fusiform, sweet-potato-like tubers, different from those produced by other known hydrophyllums. This feature, when combined with other less evident, but nonetheless diagnostic floral and indumental ones, was enough to distinguish the Arkansas plant from other related species. We resolved to look further into the problem and are glad to report that the result was both exciting and confirmative.

We conducted field surveys for *Hydrophyllum* in the Ouachitas during May of 1989 and 1990, and have assembled a study set of 15 samples from seven Arkansas counties. Also, so as to place our discovery into taxonomic context, we reviewed materials of *Hydrophyllum* from within its taxonomic complex at the herbaria of Vanderbilt University (VDB), the Missouri Botanical Garden (MO), and Harvard University (selected GH material identified as *H. macrophyllum*). These aids are hereby gratefully acknowledged.

Remarkably, a sheet of "our" plant was discovered in the loan from MO, a further indication that the Arkansas plants were noticed by others a long time ago. The specimen, annotated as *H. macrophyllum* by Constance and Beckmann, is of two small plants in flower but both lacking the distinctive rootstock. It bears the sort of cryptic label information typical of its time, but the following is legible, namely, "Ark. G. E., 403, Mai 1837." Another single line is hardly legible but can be interpreted enough to make out that the collection was made from bottomland forests along the Saline River, and the script matches that of George Engelmann, who explored much of Missouri and Arkansas by horseback during that period. Thus, we think it is fitting that the holotype be accessioned at MO.

We name the new species *Hydrophyllum brownei* in honor of Edward T. Browne, Jr., Professor Emeritus of Biology, Memphis State University, accomplished floristician, an authority on Liliaceae, and a friend who has done much to increase our knowledge of the flora of eastern Arkansas, Kentucky, and western Tennessee.

Hydrophyllum brownei Kral & Bates, sp. nov.

TYPE: United States. Arkansas: Polk Co., terraces and silty bottoms along Big Fork Creek at Opal, ca. 3 mi. N of Ark. Hwy. 8 and Big

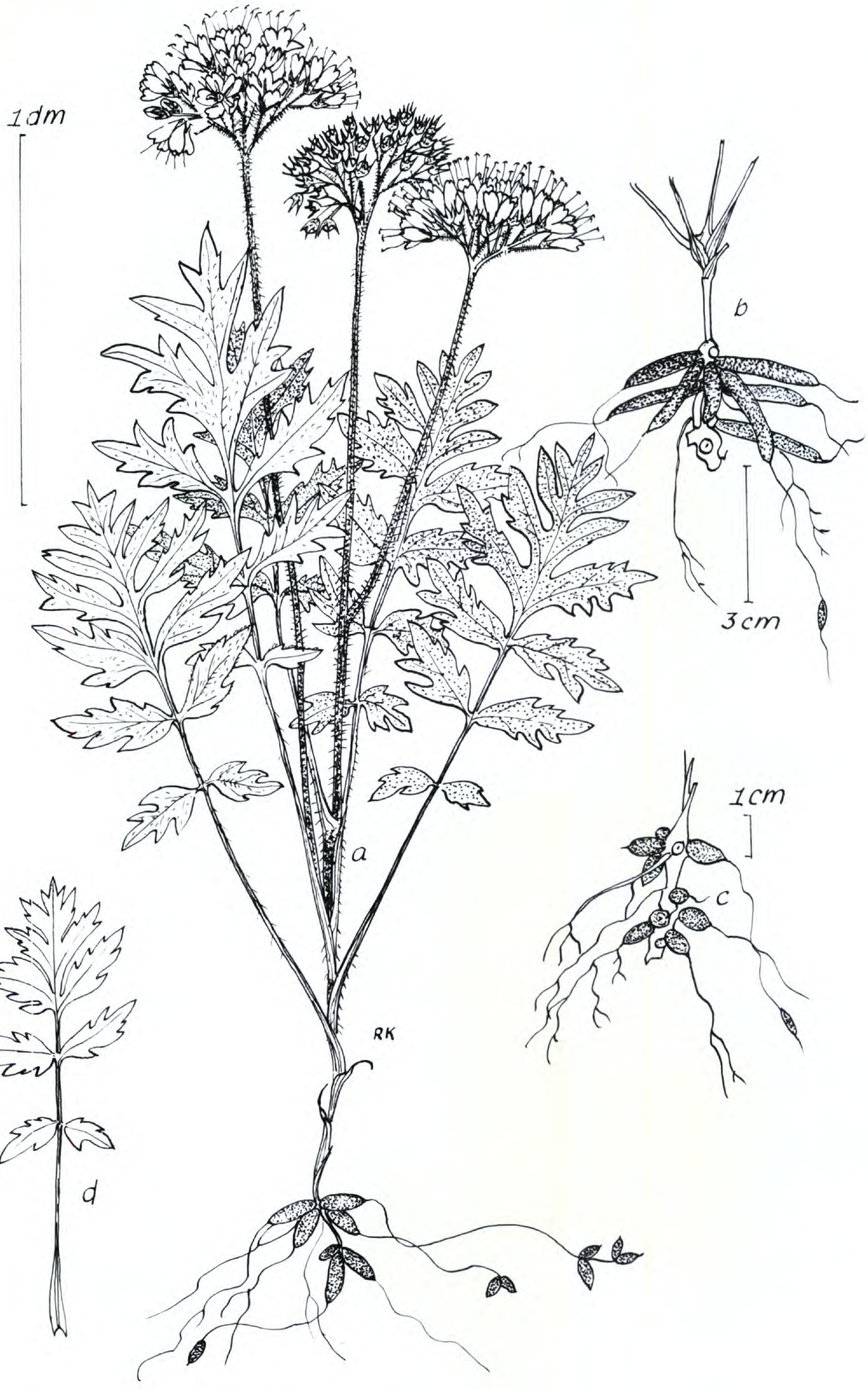

Figure 1. *Hydrophyllum brownei* Kral & Bates.—a. Habit sketch.—b. Plant base, rootstock.—c. Another rootstock morph.—d. Early leaf.

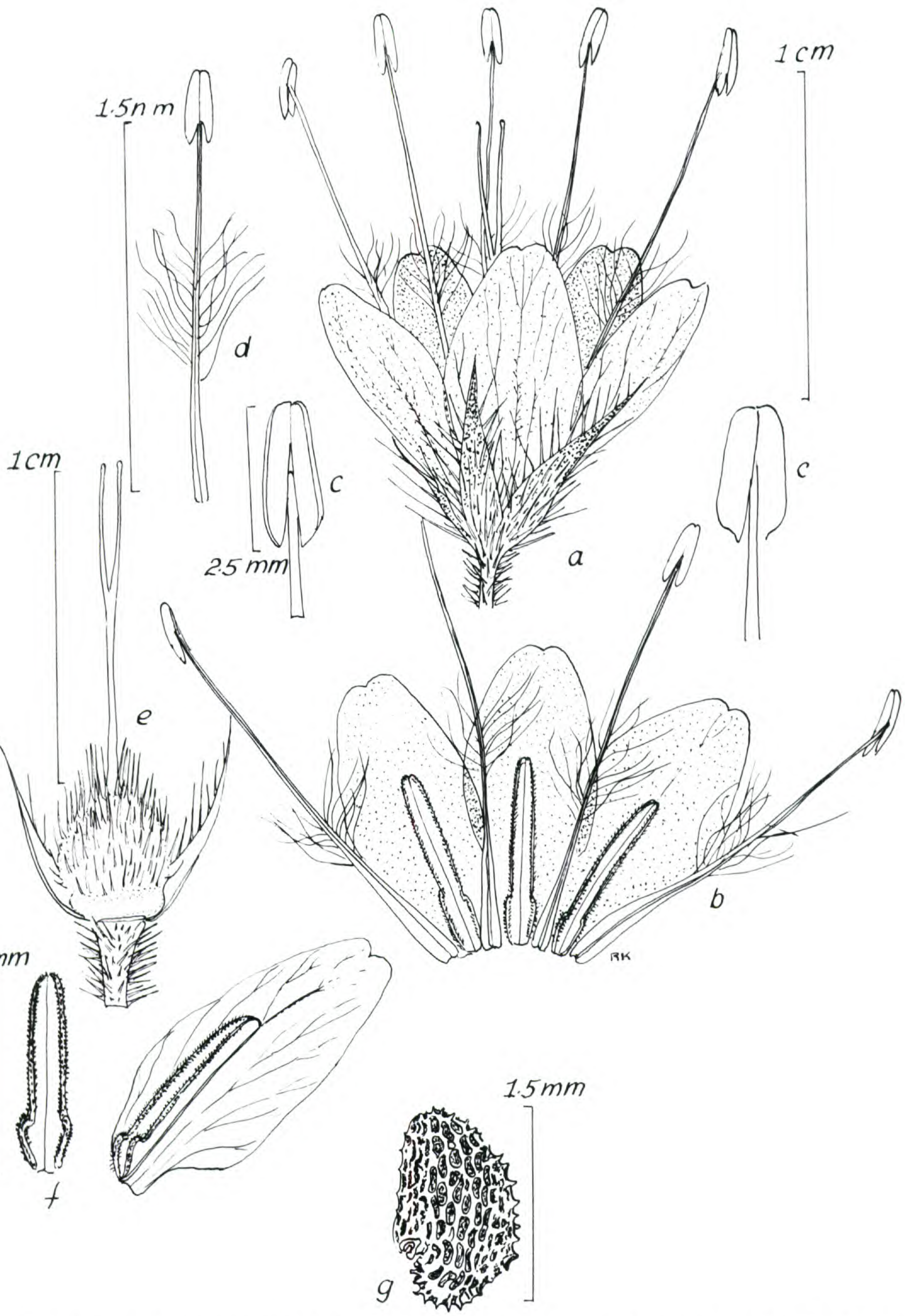

Figure 2. *Hydrophyllum brownei* Kral & Bates.—a. Side view of flower.—b. Spread portion of corolla showing three petals, four stamens, three appendages.—c. At left, adaxial view of anther; at right an abaxial view of same.—d. Stamen.—e. Gynoecium at anthesis, side view.—f. At left, a corolla appendage; at right, an oblique view of appendage as attached to petal.—g. Seed.

Fork, T2S, R28W, S28, SE1/4, 22 May 1989, *R. Kral & V. Bates 76352* (holotype, MO; isotypes, F, GH, K, NY, RSA, SMU, TENN, UC, US, VDB). Figures 1, 2.

Hydrophyllum brownei Kral & Bates; species ex affinitate H. occidentale (Wats) Gray et *H. macrophyllum* Nutt., ab utroque tuberorum forma et prolificatio distincta.

The plant perennial, suberect, subrosulate, commonly 2–5 dm high, rhizomatous, strongly tuberiferous. Rhizome much contracted, suberect, irregularly thickened, the thickenings with fascicles of tubers and with elongate-fibrous roots, these often apically tuberiferous. Tubers ellipsoid to cylindric or fusiform, 5–30 mm long, 2–5 mm thick, producing fibrous roots apically (these in turn sometimes tuberiferous). Flowering stems mostly single, gradually contracted to base, there covered by lance-oblong, erect scale leaves 1–3 cm long, upstem thickened to 3 mm, purple, terete, striate, strigo-hirsute, often retrorsely so proximally. Principal foliage leaves lyrate-bipinnatifid, 1–4 dm long; petioles variously elongate, gradually thickened and dilated toward base, clasping; blades strigo-hirsute, elliptic to narrowly obovate, the upper surface dark green (whitemottled when young) and sparsely to densely strumose-strigose with hairs mostly less than 1 mm, the lower surface paler, densely strigose-hirsute with admixtures of hirtellous hairs, the vein intervals pilose-hirsute with hairs to 1.5 mm, frequently with a pilosulous admix; primary segment pairs 3–5, the lowest commonly deflexed and more distant, upblade increasingly confluent, margin coarsely pinnatifid, pinnate or serrate, strigo-ciliate. Inflorescences multiflorous, axillary, solitary or few (2–5), suberect, the cincinni compact to somewhat lax, 2–6 cm wide, multibranched, with branches and pedicels densely and palely hispidulous or hirtellous-tomentulose; peduncles terete, variously elongate, 2–3 mm thick, purplish, pilose-hirsute with progressive increase of shorter hairs up-peduncle, striate, strict or few-branched. Calyx at anthesis 5–7 mm long (after anthesis up to 10 mm), unappendaged, the lobes linear-triangular, green, coarsely strigo-ciliate, coarsely strigo-hispid; corolla rotate-funnelform, 10–12 mm long, to 13 mm wide, pale or bright lavender to near white, smooth or externally minutely hirtellous medially and at tips; stamens inserted at corolla base, filaments ca. 15 mm, tapering, pilose at middle, anthers dark purple, oblong, 2.5–2.7 mm long, extrorse, dorsifixed; corolla appendages narrowly oblong, auriculate, concave, 4.5–5.5 mm long, the margin slightly thickened, clammy-hirtellous; ovary broadly ovoid, ca. 2 mm high, densely setose-hirsute or strigo-hirsute from middle to tip, thickened-annulate and smooth at base, the styles 9–10 mm long, the branches equaling the style base. Capsules broadly ovoid to subglobose, setose-hirsute, 3–3.5 mm long; seeds irregularly obtrigonous to obovoid, 1–2 mm long, pale to deep brown, coarsely and sharply irregularly reticulate, the hilum basal-lateral.

Paratypes. UNITED STATES. ARKANSAS: Garland Co., gravel terraces, Mazarn Creek, Pearcy Quad, T3S, R22W, Center of Sect. 25; shade of bottomland hardwoods, 13 May 1990, *Kral & Bates 77588* (GH, MO, NLU, NY, SMU, UARK, UC, VDB, WIS); Howard Co., rich hardwood bluffs by Ark. Hwy. 4, 9.6 mi. E of Wickes, 9 May 1979, *Kral 63510* (MO, UARK, VDB); rocky shaded base of bluffs above Cossatot River at Ark. Hwy. 4 bridge, 23 May 1989, *Kral & Bates* with *A. Pittman 76389* (VDB); Montgomery Co., silty sandy clay of gravelly alluvium, lower rocky slopes and rises, Caddo River ca. 4 mi. W of Norman near Mt. Gilead Church, T3S, R25W, SW quarter of Sect. 26, 12 May 1990, *Kral & Bates 77542* (BM, CLU, F, GA, GH, KANU, MO, NCU, NY, OS, PAC, RSA, TEX, UARK, UC, VDB); bottoms near Buttermilk Springs, ca. 2 mi. NE of Ark. Hwy. 27 and Caddo Gap, T4S, R24W, Sect. 1, 12 May 1990, *Kral & Bates 77554* (GH, MO, UC, VDB); sandy silty clay of bottoms along Howell Branch by Ark. Hwy. 27, 6.5 mi. S of Washita, 16 May 1990, *Kral & Bates 77617* (MO, US, VDB); Pike Co., hardwood bottoms of Little Missouri River where crossed by Ark. Hwy. 84, E of Athens, ca. 4 mi. W of Langley, 15 May 1990, *Kral 77613* (GH, K, MICH, MO, NCSC, NY, RSA, US, VDB); Polk Co., Big Fork State Natural Area, fairly common on moist ground along Big Fork Creek and in the open areas around the spring, 12 Apr. 1989, *Bates 8890* (VDB—juvenile material); stream terraces along Big Fork Creek, Big Fork State Natural Area, 12 May 1988, *Bates 7557* (VDB); Big Fork State Natural Area, R28W, T3S, Sect. 10, along Big Fork Creek, mesic wooded rocky bottom and N aspect slope, 22 May 1989, *Kral & Bates 76330* (VDB). Topotype. 13 May 1990, *Kral & Bates 77564* (AUA, BM, F, FLAS, FSU, GA, GH, IBE, K, KANU, LAF, MICH, MO, NCSC, NCU, NLU, NY, OS, PAC, RSA, SMU, TENN, TEX, UARK, UC, UNA, US, VDB, VSC); Sevier Co., hardwood bottoms along Cossatot River due E of King, W side, 15 May 1990, *Kral 77601* (F, FSU, GA, GH, K, KANU, MICH, MO, NCU, NLU, NY, PAC, SMU, TENN, UC, VDB, VSC); Yell Co., sandy silty clay of mesic hardwood rises above Petit Jean River, S side of Ark. Hwy. 309 bridge, T5N, R25W, NE quarter of Sect. 15, *Kral & Bates 77591* (GH, MICH, MO, NCSC, NLU, NY, SMU, US, VDB).

Hydrophyllum brownei is a mesic-woodland plant rooted in silt-loams or loams with a variable sand or clay fraction, and usually these soils are pocketed in talus of rich shaded slopes or the rocky, better-drained terraces along the Ouachita Mountain streams. It is, as are other eastern hydrophyllums, typically under rich deciduous forest, this mostly oak, elm, hackberry, maple, hickory, and ash. Its herbaceous associates are such common spring woodland elements as *Stellaria*, *Anemonella*, *He-*

TABLE 1. Comparison of habit, stem, branches of *H. occidentale*, *H. brownei*, and *H. macrophyllum*.

	H. occidentale	*H. brownei*	*H. macrophyllum*
Plant height	1–6 dm	1–5 dm	2–9 dm
Rootstock	Rhizome irregularly thickened, horizontal to erect	Rhizome erect or ascending, irregularly thickened	Rhizome irregularly thickened, horizontal to erect
Roots	Fascicled, the larger ones cylindric or linear-fusiform, 5–10 cm long	Fascicled, ellipsoid, short-cylindric, 0.5–3 cm long, the tubers typically producing whiplike tips, these spreading to 1 m, often repeatedly tuberiferous	Fascicled from thickened nodes, the larger ones cylindric or linear-fusiform to narrowly claviform, 5–10 cm long, these with slender tips to 10 cm, rarely proliferating
Stem and peduncle	Lower stem erect or ascending, caudiciform and sheathed by old leaf scales and bases and comparatively thick	Lower stem tapering directly to uppermost fascicle of tubers, slender, often elongate, crowned by rosette of approximate leaves	Lower stem erect or ascending, caudiciform, and sheathed by scales and old leaf bases, comparatively thick
	Aerial stem proximally (and petiole bases there) sparingly to copiously, usually retrorsely puberulent, hirsute, hirtellous or strigo-hirsute, or with admixtures of these hairs, particularly on the nerves or ribs. Upstem and on peduncles mostly more spreading, with higher percentage of shorter softer hair. Peduncle apex and branches increasingly tomentulose, hispid, pilose or hirtellous	Aerial stem proximally (and petiole bases there) sparingly to copiously, mostly retrorsely strigo-hirsute, often an admix of shorter strigillose or hirtellous pubescence, particularly on nerves and ribs. Upstem and on peduncles essentially the same or with short hairs admixed. Peduncle apex and branches increasingly tomentulose, hispid, hirsute or hispidulous	Aerial stem proximally (and petiole bases there), moderately to densely, mostly retrorsely hispid-hirsute or strigo-hirsute, also often hirtellous, hispidulous and/or strigillose, particularly on nerves and ribs. Upstem and on peduncle hairs more spreading, often mixed with finer hairs. Peduncle apex and branches increasingly tomentulose, often also sparsely hirsute
Pedicels	Puberulous with sparse admix of hirsute hairs	Puberulous with admix of hirsute hairs	Densely puberulous with admix of hirsute hairs
Principal leaves	Blade prevalently oblong or elliptic-oblong; segments 9–13, mostly ovate or elliptic, coarsely low-toothed or pinnatifid, most pairs separated by wingless rachis, lower 1–2 pairs with short petiolules or with narrowed base 2–4 mm across	Blade prevalently oblong to elliptic-oblong; segments 9–11(13), mostly ovate or elliptic-oblong, coarsely low-toothed or pinnatifid, most pairs with narrow wing-confluence, the lowest 1–few pairs not connected by wing-rachis, narrowed to short petiolules or with narrowed base 2–3 mm across	Blade oblong, elliptic or narrowly ovate; segments 9–11(13), mostly oblong, coarsely low-toothed, all or all but lowest 1(2) pairs confluent by broad rachis wing, the lower pairs connected by narrow rachis wings, usually 5–15 mm across base
Leaf—upper surface	Uniformly sparsely to copiously strigose or strigose and strigillose, no hairs longer than 1 mm	Uniformly sparsely to copiously strigose-strigillose, no hairs longer than 1 mm, most 0.5–0.8 mm long	Uniformly sparsely to copiously strigose or strigose-strigillose, longer hairs 1–1.5 mm long

TABLE 1. Continued.

	H. occidentale	*H. brownei*	*H. macrophyllum*
Leaf—lower surface	Hirsute to pilose or pilosulous on veins, pilose, hirtellous, often tomentulose between veins, most hairs under 1 mm (except some Oregon and California specimens)	Sparsely to moderately hirsute on veins, strigose, strigillose or hirtellous between veins. Hairs rarely to 1 mm	Moderately to copiously hispid, hirsute, also often hirtellous on veins (longest hairs 1–2 mm long), hirtellous to strigillose or strigose between (longer hairs mostly 1.0 mm often less than 0.5 mm)
Calyx	Accrescent, coarsely hispid-ciliate, at anthesis free to near base, lobes oblong, rounded, backs finely pubescent medially and distally	Accrescent, coarsely hispid-ciliate, at anthesis free to near base, lobes narrowly and abruptly triangular-acuminate, 4.5–7 mm, backs strigo-hispid proximally, strigillose distally	Accrescent, coarsely hispid-ciliate, at anthesis ⅔ free, lobes abruptly narrowly acuminate, 5–7 mm, backs densely tomentulose, also sparsely hispid-hirsute
Corolla	7–10 mm long, lavender to near white, lobes oblong, rounded, backs finely pubescent medially and distally	10–12 mm long, lavender to near white, lobes oblong-ovate, rounded or shallowly emarginate, backs finely, often sparsely, pubescent medially and distally	7–10(12) mm long, greenish white to yellowish white, lobes oblong, rounded or shallowly emarginate, backs densely puberulent

patica, *Sanguinaria*, *Arabis*, *Viola*, *Cardamine*, *Asarum*, *Geranium*, *Polemonium*, *Osmorrhiza*, *Thaspium*, *Zizia*, *Galium*, *Hedyotis*, *Senecio*, along with many carices, grasses, and woodland ferns.

As the habit sketch shows (Fig. 1), this plant is remarkably well adapted to the rocky detritus in which it roots. The lower stem arises variously from the tuberiferous upper rhizomal crown and can wind its slender way up between the rocks and gravel fragments, the leaves at this level scalelike and erect; then, at substrate surface and above are presented the principal leaves, the lowest of which are usually longest-petioled, most approximate, and with the most segments. Below this upper rhizomal crown, slender rhizomal internodes are displayed alternating with thickened, tuberiferous older rhizomal crowns, the number of these downward along the axis being an indication of the plant age. All tubers at the different levels are capable of producing elongate, flagelliform roots apically, these winding their way outward through the rock jumble to as much as a meter, and in turn emitting small tubers at their tips. Such a trait allows for exceptionally active cloning, as small tubers doubtless detach as propagules within the shifting or eroding, sloping substrate or in the periodically flooding, rocky, second bottoms.

Constance (1942), the acknowledged authority on *Hydrophyllum*, notes the genus as a small, exclusively North American group of eight species of bicentric distribution with four species in mesic situations in the east and four in mesic to somewhat xeric situations in the western cordilleras. Beckmann (1976, 1979), in his more recent and biosystematic assay of the genus, adopted this same taxonomy and geography and discussed at considerable length the vicarious nature of *Hydrophyllum*. He stated (1976: 1), "No single species occurs in both centers, but the genus includes two different pairs of closely related species, vicariads, one member of each pair being represented either in the eastern or western area." He is referring to the strong overlap in character states within the *H. tenuipes–H. virginianum* pair and in the *H. macrophyllum–H. occidentale* pair. It is the latter vicariad with which we deal, as these two, like *H. brownei*, are caulescent with basal and cauline leaves similar, are hairy-stemmed-and-scaped, have pinnatifid leaves with the principal segments obtuse or abruptly acute with blunt or abruptly acute marginal teeth or lobes, and have comparatively compact cymes. Within the vicariad, *H. occidentale* has the most deeply divided calyx, the softer pubescence overall, and the shorter as well as softer petiolar hair.

At this point it should be mentioned that, particularly within the vicariads, floral and trichomal characters have homologous expression, as is made plain when species are compared by means of table or conventional keys. Constance (1942) and Beckmann (1976, 1979) stress this and agree that the taxonomy of the perennial species must emphasize vegetative features, as do we. Thus, taking into account such qualifiers, we present a table (Table 1) in which character states of the new species are compared with those of *H. occidentale* and *H. macrophyllum*. The reader will note that several features (i.e., androecium, gynoecium, fruit, and seed features) are not compared, as overlapping limits of variation in these make such comparisons nearly useless.

The table reveals that *H. brownei* indeed stands apart as to character of roots and rootstock, and that it most closely resembles *H. occidentale* in leaf and leaflet shape, in indumental character of leaf and stem, in degree of sepal connation, in petal form and pigmentation as well as pubescence. However, it is difficult to interpret some specimens of *H. occidentale* from the Wilamette Valley of Oregon and from southern Oregon and northern California as to leaf trichomes, these and sometimes also the leaflets being uncomfortably similar to those of *H. macrophyllum*. The table also shows that the new species trends toward *H. macrophyllum* as to some trichomal features (overall coarser) and shape and size of calyx lobes. We have not seen living specimens of *H. occidentale* but note from specimens, photographs, and illustrations that *H. brownei* resembles it far more than does its closer neighbor, *H. macrophyllum*.

When one examines distribution maps for the *H. occidentale*, *H. brownei*, and *H. macrophyllum*, showing the three allopatric loci from the more recent western cordilleran systems that contain *H. occidentale*, and the two older physiographic eastern provinces that support *H. brownei* and *H. macrophyllum*, respectively, it becomes possible to construct a reasonble hypothesis for origin of this vicariad, as did Beckman and other workers before him. The best explanation appears to be that there was a continuous and nearly transcontinental distribution of ancestral stock, which over time and because of geologic and climatic shift became discontinuous. The greatest clinal range is expressed by *H. occidentale*, not suprisingly as this species occupies at once the greatest area and the most diverse ecology. Interestingly, the most eastern material of that plant shows the most resemblance to populations of *H. brownei*.

We still have some follow-up work to do. There are sight records of *Hydrophyllum* arbitrarily determined as *H. macrophyllum* from areas north of the Ouachitas in Arkansas. We know that the few old records from that complex that were gotten by Engelmann and Demaree from the Ouachita trend are indeed *H. brownei*, but we still have to locate and determine those northern records, which, if indeed turn out to be *H. macrophyllum*, would constitute the only records of the latter from west of the Mississippi. Also, we do not yet have chromosomal information; but as all other known hydrophyllums have been found to have haploid complements of 9, there is some measure of confidence that *H. brownei* is the same. Also of interest is the fact that the Ouachita Mountains of Arkansas and contiguous Oklahoma are remarkably high in recently described endemics and may well be the most suprising floristic area within the Interior Highlands physiographic province. To name some that have been described in recent decades one can include graminoids such as *Carex latebracteata* Waterfall, *C. ouachitana* Kral, Bryson & Manhart, *Calamovilfa arcuata* K. Rogers (bicentric, with one locus in the Tennessee Cumberlands, the other the Ouachitas) and other species such as *Streptanthus squamiformis* Goodman, *Amorpha ouachitensis* Wilbur, *Monarda stipitatoglandulosa* Waterfall, *Hedyotis ouachitana* E. B. Smith, *Polymnia cossatotensis* Pittman & Bates, and *Solidago ouachitensis* Taylor & Taylor.

At present, it appears that *H. brownei* is the only species of its genus to be found within the Ouachita Mountains Natural Division, and as such it poses some interesting phytogeographic questions as to the nature of vicariads in that genus. As we now have several localities for the species within protected areas of the Ouachita National Forest, it is reassuring to know that it stands in little danger of extirpation.

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Novelties in *Draba* (Brassicaceae) from Venezuela, Ecuador, and Peru

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Draba L., the largest genus in the Brassicaceae (Cruciferae), includes some 350 species distributed primarily in the Northern Hemisphere, especially in arctic and subarctic regions, and also in montane and alpine portions of temperate regions (Al-Shehbaz, 1987). The genus is well developed in South America, where 65–70 species grow along the Andes from Colombia and Venezuela south into Patagonia. Many of these species are poorly understood, and several others have been described only recently (Al-Shehbaz, 1989; Rangel & Santana, 1989).

The South American members of *Draba* belong to several species complexes, of which the taxonomy is much in need of critical study. A revision of the genus is now in progress. Because this revision will take several years to complete, it is felt necessary to publish the novelties and nomenclatural changes in advance in order to make these names available for various floristic and inventory studies.

Draba steyermarkii Al-Shehbaz, sp. nov. TYPE: Ecuador. Azuay: páramos, in vicinity of Toreador, between Molleturo and Quinoas, 3,810–3,930 m, 15 June 1942, *Steyermark 53077* (holotype, F; isotypes, GH, MO, NY, S).

Draba violacea Humb. & Bonpl. var. *lehmanniana* O. E. Schulz, Das Pflanzenreich IV. 105(Heft 89): 154. 1927. TYPE: Ecuador. Páramo del Cajas, Cuenca, 3,700--4,000 m, *Lehmann 6477* (holotype, B; photos, F, GH, MO).

Fruticulus (3–)10–25(–45) cm altus; folia oblonga, 7–12(–18) mm longa, dense imbricata, supra pilis simplicibus pilosa, subtus pilis stellatibus subtomentosa, basibus persistentibus; racemi bracteati; petala late obovata, unguiculata, intense purpurea vel raro lilacina, (8–)9–12(–13) mm longa, (3.5–)4–5 mm lata; siliquae oblongae vel oblongo-lanceolatae, compressae, (8–)10–15 mm longae, 3–4 mm latae; styli (2.5–)3.5–5 mm longi.

Subshrubs or rarely suffrutescent herbs. Stems erect, single or few from the base, (3–)10–25(–45) cm tall, the lower portion to 6 mm diam., covered with persistent, thickened leaf remains of previous years. Leaves narrowly to broadly oblong, 7–12(–18) mm long, (2–)2.5–3.5(–4) mm wide, densely overlapping, often subappressed to stem, acute to obtuse, entire; upper surface sparsely to densely pilose with appressed, antrorse, fine, straight trichomes; lower surface subtomentose with short-stalked to subsessile, stellate or rarely cruciform trichomes, the rays slender, 1 or 2 of which are usually furcate; base of midrib thickened, triangular, persistent. Inflorescences bracteate, corymbose racemes, slightly elongated in fruit. Sepals erect, caducous, oblong, 4–5 mm long, 2–3 mm wide, purple or green with purplish apex and margin, glabrescent or sparsely pilose, the inner pair slightly saccate at base. Petals broadly obovate, deep purple or rarely lilac, clawed, (8–)9–12(–13) mm long, (3.5–)4–5 mm wide, rounded or slightly emarginate at apex; claws nearly as long as sepals. Filaments erect, slender, dilated at base, white, 5–6 mm long; anthers yellow, oblong, 1–1.2 mm long. Nectar glands confluent, subtending the bases of all filaments. Fruiting pedicels slender, pubescent, divaricate to ascending, straight or slightly curved, (4–)7–12(–17) mm long. Fruits oblong to oblong-lanceolate, compressed, softly pubescent, (8–)10–15 mm long, 3–4 mm wide, straight or usually curved; style slender, (2.5–)3.5–5 mm long; stigma small, entire. Seeds ovate, compressed, dark brown, 1–1.4 mm long, 0.6–0.7 mm wide.

Flowering sporadically throughout the year; grows at altitudes of 2,700 to 4,400 m in grass páramo, rock crevices, and *Polylepis* woods.

Paratypes. ECUADOR. AZUAY: Cordillera Occidental, Páramo de Las Cajas "PLC," 37.5 km from Cuenca on road to Molleturo, 1–2 km W of pass, *Molau & Öhman 1473* (GB); PLC, *Harling & Andersson 23363* (GB, QCA); PLC, W slope, ca. 1 km above Mihuir, *Harling & Andersson 24626* (GB, QCA); PLC, Lagunas Suerococha, ca. 35 km on Cuenca–Molleturo road, 2–3 km beyond the pass, *Molau & Eriksen 2825* (GB), 1 km NW of pass, *Molau & Eriksen 2767* (GB); PLC, road from refugio to Migüir, about 6 km from the refugio, *Eriksen & Boysen Larsen 45770* (AAU); Cajas National Park, Cuenca–Molleturo road, *Clemants, Boeke, N. Holmgren & Crisafulli 2155* (NY, QCA), *Jaramillo 7194* (NY, QCA).

This taxon was recognized by Schulz (1927) as *D. violacea* var. *lehmanniana*. The latter is based on a specimen annotated in Gilg's handwriting as *D. lehmanniana*, a name that was never published at the specific rank. For reasons given below, I recognize this taxon as a species based on a different

type collection with excellent flowering and fruiting material, rather than elevating to the specific rank a variety whose fragmentary type consists of flowering material only.

Draba steyermarkii is closely related to *D. violacea* and *D. alyssoides* Humb. & Bonpl. From the latter, it is readily distinguished in having purple petals (8–)9–12(–13) mm long, styles (2.5–)3.5–5 mm long, and subtomentose lower leaf surface with finely stellate or rarely cruciform trichomes. In contrast, *D. alyssoides* has white petals 5.5–6.5(–7.5) mm long, styles (0.8–)1.5–2.2(–3) mm long, and scabrous lower leaf surface with coarse, usually stiff, furcate, trifid, or cruciform trichomes. *Draba steyermarkii* differs from *D. violacea* by its oblong, green leaves, whose pilose upper surfaces are covered exclusively by simple trichomes, and by its small (1–1.4 × 0.6–0.7 mm) seeds. The latter has obovate, white-tomentose leaves, whose upper surfaces are densely covered by a mixture of very fine stellate and simple trichomes, and has slightly larger (1.5–1.7 × 0.8–1.1 mm) seeds.

Draba venezuelana Al-Shehbaz, sp. nov. TYPE: Venezuela. Mérida: Distrito Rivas Dávila, extremo septentrional del páramo del El Batallón, entre la Torre de TV y Laguna Grande, entrando por El Portachuelo, 3,400 m, 22 Dec. 1972, *Ruiz-Terán & López-Figueiras 8308* (holotype, MO; isotype, GH).

Herba perennis suffruticosa multicaulis; caules decumbentes, hirsuti, 10–17 cm longi; folia caulina sessilia, dentata, oblonga vel ovata, nonciliata, inferne pilis stipitato-furcatibus vel stellatis, superne pilis simplicibus et stellatis praedita; racemi ebracteati; petala flava, unguiculata, 4.5–6 mm longa; pedicelli fructiferi divaricati, recti, hirsuti, 3–8 mm longi; siliquae ovatae vel ellipticae, compressae, glabrae, 4–6 mm longae, 2.5–3 mm latae; styli 0.9–1.2 mm longi.

Suffrutescent herbs 10–17 cm tall. Stems slender, several from the base, decumbent, covered with foliar remains of previous years, hirsute throughout with spreading simple trichomes to 0.7 mm long, these mixed with stalked furcate trichomes. Lowermost leaves rosulate, short petiolate, oblong to oblanceolate, rounded at apex, entire, nonciliate, 7–18 mm long, 2–7 mm wide, pubescent on both surfaces with short-stalked, furcate, trifid, and cruciform trichomes; petiolar bases persistent, becoming papery. Cauline leaves sessile, ovate to oblong or oblong-linear, 5–14 mm long, 2–5 mm wide, obtuse to subacute at apex, dentate, nonciliate, with indumentum similar to that of basal leaves except the upper surface usually with preponderance of simple trichomes. Inflorescences corymbose racemes, elongated considerably in fruit, ebracteate or rarely the lowermost flowers bracteate. Sepals erect, caducous, broadly oblong to ovate, 1.8–2.5 mm long, nonsaccate, rounded at apex, sparsely pubescent. Petals yellow, broadly obovate, clawed, emarginate, 4.5–6 mm long, 3–4 mm wide; claws ca. 2 mm long. Filaments erect, slender, 1.7–3 mm long; anthers broadly ovate to suborbicular, 0.4–0.5 mm long. Nectar glands confluent, subtending the bases of all filaments. Fruiting pedicels 3–8 mm long, divaricate, straight, hirsute with a mixture of simple, furcate, and stellate trichomes. Fruits ovate to elliptic, compressed, 4–6 mm long, 2.5–3 mm wide; valves with a prominent midvein, glabrous or rarely with a few trichomes near the replum; septum complete; style slender, 0.9–1.2 mm long; stigma entire. Seeds 1 or 2 per locule, ovate, compressed, 1.8–2.1 mm long, 1.3–1.5 mm wide.

Paratypes. VENEZUELA. MÉRIDA: Distrito Rivas Dávila, Canada de la quebrada La Ferruginosa, extremo septentrional del páramo del El Batallón, 3,300 m, *Ruiz-Terán, López-Figueiras & Griffin 12600* (GH, MO); Páramo El Batallón, 3,000–3,600 m, *Charpin, Jacquemoud & Ruiz-Terán AC-13542* (G).

Draba venezuelana is related to the Colombian *D. pachythyrsa*, from which it differs in having several woody stems from the base, ebracteate inflorescences, petals 4.5–6 mm long, hirsute, straight fruiting pedicels, glabrous fruits, styles 0.9–1.2 mm long, and seeds 1.8–2.1 mm long. In contrast, *D. pachythyrsa* has one or few stems from a thick, unbranched caudex, inflorescences bracteate throughout, petals 2.8–3.5 mm long, stellate, recurved fruiting pedicels, puberulous fruits, styles (0.2–)0.3–0.5(–0.6) mm long, and seeds 1.3–1.6 mm long. The presence of uniform indumentum of short-stalked, furcate to cruciform trichomes on the basal leaves is also a distinctive feature of *D. venezuelana*. This aspect of indumentum, as well as the lack of setose cilia on the leaves and the shorter styles, should readily distinguish *D. venezuelana* from the Venezuelan *D. pamplonensis*. The latter has setose-ciliate leaves and styles 2.5–3 mm long.

Draba wurdackii Al-Shehbaz, sp. nov. TYPE: Peru. Amazonas: Prov. de Chachapoyas, upper slopes and summit of Cerro Campanario, 3,600–3,900 m, 3 Aug. 1962, *Wurdack 1577* (holotype, US #2404314).

Herba perennis suffruticosa; folia oblonga vel elliptica, scabra, denticulata, sessilia, inferne pilis trifidis subsessilibus praedita; sepala oblonga, 2.5–3 mm longa; petala flava, spathulata, 3–3.5 mm longa; siliquae anguste oblongae, 6–9 mm longae, 2–2.5 mm latae; valvae puberulae vel hirsutulae, obtusae; styli 0.4–0.5 mm longi.

Slender, suffrutescent perennial herbs. Lower stems woody, stramineous, to 1 mm wide, without foliar remains of previous years; upper stems leafy, stellate-pubescent, 3–5 cm long. Leaves oblong to elliptic, 3–10 mm long, 1–4 mm wide, scabrous, acute, denticulate, usually with 2 or 3 teeth on each side, cuneate to a sessile base; upper surface with subappressed simple trichomes to 0.8 mm long, these are mixed with short-stalked furcate or trifid trichomes; lower surface with predominantly subsessile or short-stalked, trifid trichomes mixed with smaller, fewer, cruciform trichomes, the rays unbranched. Inflorescences few-flowered, corymbose racemes, slightly elongated in fruit, the lower portion bracteate. Sepals erect, oblong, caducous, 2.5–3 mm long, rounded at apex, yellowish and scarious at margin, nonsaccate, sparsely hirsute with simple and furcate trichomes. Petals pale yellow, spatulate, not clawed, 3–3.5 mm long; ca. 1.3 mm wide. Filaments yellowish, erect, 2–2.2 mm long; anthers oblong, 0.4–0.5 mm long. Nectar glands confluent, subtending the bases of all filaments. Fruiting pedicels divaricate, straight, 3–6 mm long, pubescent with trifid trichomes. Fruits narrowly oblong, compressed, 6–9 mm long, 2–2.5 mm wide; valves obtuse at both ends, puberulous or hirsutulous with simple trichomes to 0.2 mm long; septum complete; style 0.4–0.5 mm long; stigma entire. Seeds ovate, compressed, ca. 1.2 × 0.8 mm.

Draba wurdackii is most closely related to *D. peruviana*, from which it is easily distinguished in having slender stems without foliar remains, lower leaf surfaces with predominantly trifid trichomes with unbranched rays, yellow petals 3–3.5 mm long, narrowly oblong fruits with obtuse valves, and styles 0.4–0.5 mm long. In contrast, *D. peruviana* is a subshrub that has stout stems with foliar remains, lower leaf surfaces with stellate trichomes, of which some rays are furcate or trifid, white petals 7–10 mm long, broadly oblong (rarely ovoid or subelliptic) fruits with acute valves, and styles 1.5–3 mm long.

Draba funckii (Turczaninow) Al-Shehbaz, comb. nov. Basionym: *Dolichostylis funckii* Turczaninow, Bull. Soc. Imper. Nat. Mosc. 27(2): 306. 1854. *Draba lindenii* (W. J. Hooker) Planchon var. *funckii* (Turczaninow) O. E. Schulz, Das Pflanzenreich IV. 105(Heft 89): 161. 1927. *Draba dendroides* Linden & Planchon, Trois. Voy. Linden, Bot., Pl. Columb. 1: 15. 1874/1875. TYPE: Venezuela. Mérida: Sierra Nevada, 10,000 ft., *Funk & Schlim 1606* (holotype, KW n.v.; isotypes, G (photos, F, MO), P).

Schulz (1927) treated *Draba funckii* as a variety of the closely related *D. lindenii*. The differences between the two are sufficient enough to treat them at the specific rank. *Draba funckii* has ebracteate inflorescences, rachises tomentose with stellate trichomes, ciliate leaves with tomentose lower surface, and flowers with small sepals (4–5 mm), petals (5–7 mm), filaments (5–6 mm), and anthers (0.8–1 mm). *Draba lindenii* has inflorescences bracteate along entire length, rachises hirsute to pilose with simple and furcate trichomes, nonciliate and completely glabrous leaf blades, and flowers with larger sepals ((5.5–)6–9 mm), petals (10–14 mm), filaments ((6.5–)8–14, and anthers (1.4–1.8 mm). Unfortunately, *D. funckii* is known only from the type collection, and further gatherings should provide a better understanding of the variability within the species.

Draba pulvinata Turczaninow subsp. **berryi** Al-Shehbaz, subsp. nov. TYPE: Venezuela. Mérida: Distrito Miranda, páramo en las cabeceras de la Quebrada El Turmero (afluente del Río Motatán), a 11.7 km El Aguila por la carretera a Piñango, 4,100 m, 16 Mar. 1983, *Berry 4030* (holotype, MO).

Folia aciliata, inferne tomentosa stellata, superne pilosa; racemi pedunculati; siliquae glabrae vel sparse pubescentes.

Leaves nonciliate; lower surface densely tomentose with fine stellate trichomes with 2- or 3-fid rays; upper surface pilose with appressed, simple or stalked furcate trichomes. Peduncles (3–)5–15 mm long. Fruits glabrous to sparsely pubescent.

Flowering February through May; grows on rock outcrops in páramo at altitudes of 2,550–4,300 m.

Paratypes. VENEZUELA. TRUJILLO: Distrito Urdaneta, La Morita, cresta arriba después de La Capilla, páramo de Tuñame, en la carretera Jajó-Tuñame, *Ruiz-Terán & López-Figueiras 2188* (GH). MÉRIDA: Sierra de Santo Domingo, western flank of Pico Mucunuque, above Laguna Mucubaji, *Dawson & Pfitsch 84* (GH); entre las Lagunas El Yoyo y de Barrios, *Gehriger 82* (F, G, MO); Laguna El Yoyo, *Gehriger 64* (US); páramo de las Piedras Blancas, *Vareschi & Pannier 1221* (MER), *Solbrig 4703* (GH); along road from Pico Aguila to Piñango, *Dawson & Pfitsch 51, 91* (GH); Distrito Libertador, alrededores de la Laguna del Santo Cristo, 20 km al S de Mucuchíes, 3,620 m, 22 May 1973, *Ruiz-Terán 8481* (MO); Distrito Justo Briceño, páramo NW del Alto de Totumo, hoya del Río Chirurí, a 19.5 km de El Aguila por la carretera a Piñango, *Berry 3894* (GH, MO); Distrito Campo Elías, entre La Mesa y El Hoyo, vertiente oriental del pico El Campanario, páramo de Los Conejos, Sierra de la Culata, *Ruiz-Terán 6939* (GH); Distrito Rangel y Justo Briceño, páramo Las Cruces (páramo de Mucuchíes), a 6.3 km de

El Aguila por la carretera a Piñango, *Berry 4070* (MO); Distrito Miranda, páramo en las cabeceras de la Quebrada El Turmero (afluente del Río Motatán), a 13.3 km de El Aguila por la carretera a Piñango, *Berry 4077* (MO); same area but 12 km from El Aguila, *Berry 3817* (MO); 10.3 km from El Aguila, *Berry 4106* (MO).

The two subspecies of *Draba pulvinata* apparently have the same distributional range. They are indistinguishable in almost every aspect of floral and fruit morphology, and it is because of these facts that I am recognizing them at the subspecific instead of specific rank. Subspecies *berryi* is readily separated from subsp. *pulvinata* by its nonciliate leaves, with finely tomentose lower surface and an appressed pilose upper surface, and by its pedunculate infructescences. Subspecies *pulvinata* has ciliate leaves with glabrous surfaces, or sometimes only the lower surface is coarsely stellate, and it usually has subsessile infructescences. It is not known if the two taxa are sympatric and whether or not they hybridize.

Draba matthioloides Gilg & O. E. Schulz subsp. **saundersii** Al-Shehbaz, subsp. nov. TYPE: Peru. Libertad, Prov. Santiago de Chuco, Cerro Pirgush, near Lake Pelagatos, Dist. Mollepata (?), 13,500 ft. [ca. 4,430 m], 1 July 1964, *Saunders 926* (holotype, K).

Petala purpurea; siliquae glabrae, leviter inflatae; styli 2–4 mm longi.

Petals purple; fruits glabrous, slightly inflated; style 2–4 mm long.

Draba matthioloides subsp. *saundersii* is indistinguishable from subsp. *matthioloides* in nearly all aspects of habit, leaf, flower, and fruit. It is readily distinguished from the type subspecies by its purple flowers, glabrous fruits, and shorter (2–4 mm) styles. Subspecies *matthioloides* has orange to yellow flowers, tomentose fruits, and styles (4–)5–10 mm long. Because of the taxonomic significance of flower color in *Draba*, one might be tempted to recognize these two taxa as separate species. Only five specimens of the two subspecies were available for study, however, and in the absence of further material, the overall variation in these characters cannot be fully understood.

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The South American *Dictyophragmus* (Brassicaceae)

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Two of the approximately 350 South American species of Brassicaceae (Cruciferae) have broadly flattened, linear to linear-lanceolate fruits, broadly winged seeds, and accumbent cotyledons. The first is a Peruvian species described by Muschler (1908) as *Streptanthus englerianus* Muschler and was later transferred by Schulz (1933) to the monotypic *Dictyophragmus* O. E. Schulz. The second is a recently discovered Argentinian species described by Romanczuk (1982) as *Sisymbrium punense* Romanczuk. Except for the superficial resemblance in fruits and seeds, the two species have little in common with the exclusively North American *Streptanthus* Nuttall. Because of the common occurrence in unrelated genera of the Brassicaceae of broadly flattened fruits, broadly winged seeds, and accumbent cotyledons, it is safe to conclude that this character combination evolved independently several times within the family.

Sisymbrium punense and *Dictyophragmus englerianus* (Muschler) O. E. Schulz are glabrous annuals with auriculate to amplexicaul cauline leaves, small, white flowers, confluent nectar glands, entire stigmas, broadly flattened fruits, accumbent cotyledons, and broadly winged seeds. Despite the significant morphological differences and geographical disjunction, the two species are more closely related to each other than to any South American Brassicaceae. In my opinion, their relationship is better understood by placing them in one genus than by recognizing two monotypic genera, of which one should be segregated as new.

Perhaps the nearest relative of *Dictyophragmus* is the South American *Eremodraba* O. E. Schulz, a genus of two species, one of which is narrowly endemic to southern Peru and the other restricted to adjacent northern Chile (Al-Shehbaz, 1990). Species of these genera are glabrous annuals with amplexicaul cauline leaves, small flowers, confluent nectar glands, entire stigmas, and flattened fruits. On the basis of differences in the cotyledonary position, Schulz (1936) placed *Dictyophragmus* in the tribe Arabideae and *Eremodraba* in the Sisymbrieae. Students of the Brassicaceae now place much less emphasis on the cotyledonary position, and evidently the boundaries between the Arabideae and Sisymbrieae are highly artificial. It is even doubtful that these tribes are distinct or natural. In my opinion, one should be cautious about the rigid use of characters such as the cotyledonary position in assessing relationships at higher taxonomic levels within the family. In addition to the differences in cotyledonary position, *Eremodraba* has yellow flowers and wingless, plump, oblong seeds. In contrast, *Dictyophragmus* has white flowers and broadly winged, flattened, orbicular to broadly ovate seeds.

Systematic Treatment

Dictyophragmus O. E. Schulz, Bot. Jahrb. Syst. 66: 92. 1933. TYPE: *D. englerianus* (Muschler) O. E. Schulz.

Annual herbs, glabrous throughout. Cauline leaves sessile, auriculate to amplexicaul at base. Inflorescences bracteate or ebracteate racemes, elongated in fruit; flowers small. Sepals oblong, erect, nonsaccate, glabrous. Petals white, obovate or spatulate; claws papillose or glabrous. Nectar glands confluent, low, surrounding the bases of lateral filaments, subtending those of the median ones. Stamens 6; filaments glabrous or papillose at base. Fruits flattened parallel to the septum, linear to linear-lanceolate, glabrous, torulose; valves with a prominent midvein or inconspicuously veined; septum complete, veinless or prominently veined; stigma entire. Seeds flattened, reticulate, uniseriately arranged, broadly winged all around except at the proximal end; cotyledons accumbent.

Key to the species

1a. Inflorescences ebracteate; fruits 1.5–3(–3.6) cm long; valves with an inconspicuous midvein; septum with prominent, anastomosing longitudinal veins; seeds 3–8 per locule; filaments and claws papillose at base ..... 1. *D. englerianus*
1b. Inflorescences bracteate; fruits (3–)3.5–7 cm long; valves with a prominent midvein; septum veinless; seeds 12–25 per locule; filaments and claws glabrous ..... 2. *D. punensis*

1. Dictyophragmus englerianus (Muschler) O. E. Schulz, Bot. Jahrb. Syst. 66: 92. 1933. *Streptanthus englerianus* Muschler, Bot. Jahrb.

Syst. 40: 269. 1908. TYPE: Peru. Mollendo, 100–200 m, 10 Oct. 1902, *A. Weberbauer 1463* (holotype, B).

Annual herbs, glabrous throughout. Stems erect, simple or branched, 4–25 cm tall. Lowermost leaves subsessile to short petiolate, oblong to oblanceolate, repand-dentate, 1.5–5 cm long, 4–18 mm wide; cauline leaves few, smaller, auriculate to amplexicaul at base. Sepals narrowly oblong, 2–2.5 mm long, 0.9–1.2 mm wide. Petals obovate, abruptly narrowed to the claw, 4–6 mm long, 1.2–1.8 mm wide; claws slender, conspicuously papillose. Filaments erect, white, 2.5–3 mm long, papillose at base; anthers narrowly oblong, 0.9–1.1 mm long. Fruiting pedicels divaricate, straight to slightly curved upward, 3–6 mm long. Fruits linear-lanceolate to linear, torulose, straight, 1.5–3(–3.6) cm long, 3–4 mm wide; valves prominently transverse-reticulate on the inside, obscurely veined on the outside, the midvein inconspicuous; septum with prominent, anastomosing longitudinal veins; style obsolete or rarely to 0.4 mm long. Seeds 3–8 per locule, suborbicular to broadly ovate, 2.5–3 mm diam., reticulate; wings 0.3–0.6 mm wide.

Endemic to a small coastal area in Depto. Arequipa, Peru, where it grows on sandy plains and hills at altitudes up to 400 m.

Specimens examined. PERU. DEPTO. AREQUIPA: Prov. Camaná, between Camaná and Ocoña, ±40 km to the north, *Ferreyra 8870* (GH); between Camaná and Ocoña, *Ferreyra & Ono 20334* (GH); same area, *Ferreyra 6455* (GH, US); Mollendo, hillside directly back of the port, *Johnston 3555* (GH, K); Lomas of Ocoña, ca. 12 km S of Ocoña (km 788 S of Lima on Pan American Hwy.), *Dillon & Dillon 3858* (F, MO); 5 km E of Mollendo, *Worth & Morrison 15762* (F, MO).

2. Dictyophragmus punensis (Romanczuk) Al-Shehbaz, comb. nov. Basionym: *Sisymbrium punense* Romanczuk, Darwiniana 24: 87. 1982. TYPE: Argentina. Prov. Jujuy: Depto. Cochinoca, Abra Pampa, Cuesta Azul Pampa, 21 Feb. 1952, *R. Diers 132* (holotype, SI).

Annual herbs, glabrous throughout, sometimes glaucous. Stems erect, branched, 8–30(–40) cm tall. Lowermost cauline leaves lanceolate, sessile, dentate to repand or rarely entire, 2–6 cm long, 3–8 mm wide; middle and upper cauline leaves progressively smaller and becoming entire upward, strongly auriculate to amplexicaul, the auricles up to 5 × 3 mm. Inflorescences lax racemes, bracteate throughout, elongated considerably in fruit; rachis straight to flexuous; bracts auriculate, longer to shorter than the pedicels. Sepals oblong, 2–4 mm long, 0.9–1.2 mm wide. Petals spatulate, attenuate to a clawlike base, 4–5 mm long, 0.7–1.3 mm wide. Filaments erect, white, 2–3 mm long; anthers oblong, 0.8–1.5 mm long. Fruiting pedicels curved upward or rarely straight and divaricate, 5–20(–30) mm long. Fruits narrowly linear, straight to slightly curved, (3–)3.5–7 cm long, 2.5–3 mm wide; valves with a prominent midvein and obscurely reticulate lateral veins, longitudinally striate on the inside; septum hyaline, veinless; style 0.8–1.8 mm long. Seeds 12–25 per locule, suborbicular, 2–2.5 mm diam., reticulate; wing 0.4–0.8 mm wide.

A very rare Argentinian species endemic to Prov. Jujuy, where it grows at altitudes of 3,400 to 3,800 m.

Specimens examined. ARGENTINA. PROV. JUJUY: Depto. Humahuaca, Iturbe, *Cabrera, Frangi, de Frangi, Gayoso, Kiesling & Zardini 21394* (BAA); Cuesta de Azul Pampa, *Ruthsatz 374/17* (BAA, MO); Mina El Aguilar, Epinazo del Diablo, *Ruthsatz 23/1* (BAA, MO), *Ruthsatz 23/8* (BAA); Depto. Purmamarca, Tascal, *Cabrera 15139* (BAA, GH).

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Orchidaceae Dunstervillorum I: a New *Dryadella* from the Venezuelan Guayana

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This paper is the first of a series describing new orchid taxa based on material collected by and illustrations prepared by the late G. C. K. Dunsterville. This effort is the first step toward publication of a new volume (number 7) in the series *Venezuelan Orchids Illustrated*, which will include some 100 previously unpublished line drawings now belonging to Nora Dunsterville.

The genus *Dryadella* Luer is a recent segregate of *Masdevallia* Ruíz & Pavón (Luer, 1978). It comprises ca. 40 species distributed in Central America and Andean South America (Luer, 1986: 26), with a secondary center in southern Brazil. The genus seems to be absent from Andean and coastal Venezuela. The new species described here, the only *Dryadella* reported from Venezuela, was previously illustrated as *Dryadella osmariniana* (P. Braga) Luer in Dunsterville & Garay (1979).

Dryadella lueriana Carnevali & G. A. Romero, sp. nov. TYPE: Venezuela. Bolívar: epiphytic in dense, wet, mossy forest near summit of Cerro Guaiquinima, close to the western cliff margin, 1,650 m, May 1978, *Dunsterville & E. Dunsterville 1399* (holotype, AMES; isotypes, MO, VEN). Figure 1.

Species haec *Dryadellae simulae* (Reichb. f.) Luer similis, sed habitu floribusque multiminoribus, sepalis non maculatis, petalis subquadratis obtusis et labelli minimi lamina obovata differt. Cum *Dryadella osmariniana* (Braga) Garay & Dunsterv. confusa, sed planta floribusque minoribus, rhizomate repente, foliis lineari-ellipticis proportione latioribus, labello breviori latiori et habito montano recedit.

Epiphytes, 10–20 mm high; rhizome shortly creeping to abbreviate, clothed by tubular sheaths. Stems 2–3(–4) mm long, erect to subhorizontal, 1-articulate, clothed by 2–3 thin, tubulose, loose sheaths. Leaves 8–15(–25) mm long, 1.5–3.5(–4) mm wide, thickly coriaceous, midnerve sulcate, erect to suberect, linear-elliptic, elliptic to oblanceolate, acute to obtuse, apex fleshily short-mucronate, basally narrowed into a short, wide pseudopetiole. Inflorescences 2–6 mm long, a solitary flower borne successively in a subdense 2–3(–4)-flowered raceme, originated from ca. ½ the length of the stem, subtended by a ca. 0.2 mm long, triangular, acute sheath; peduncle 1–2 mm long, subterete, clothed by a tubulose, loose sheath; floral bract 2–3 mm long, tubulose in the lower ½, imbricating above, thin, loose, when flattened elliptic, abruptly short acuminate, midnerve apically keeled; pedicel 2.5–4 mm long, subterete, longer than the bract, white; ovary 0.7–1 mm long, 3-winged, white. Flowers resupinate, campanulate; sepals 3-nerved, pale brown, largely overlaid by red, darker dorsally along the nerves, midnerves prominently keeled, margins cellular; dorsal sepal 4–5 mm long, 2–2.3 mm wide, ovate, apex acute, thickened, concave and hooded over the column and labellum, basally connate to the lateral sepals for 4–5 mm to form a sepaline cup; the lateral sepals 3–4 mm long, ca. 1.5 mm wide, ovate, acute, oblique, base connate for ca. 0.5 mm above the base and strongly folded into a small mentum, internally with a transverse callus 0.1–0.2 mm long above the decurved base; petals ca. 1 mm long, ca. 1 mm wide, tenuously 2-nerved, subquadrate to broadly obovate-oblong, with an acute angle and an acute, subapical tooth 0.1 mm long on both sides, apex obliquely truncate, rounded or obtuse. Labellum 1.7–1.8 mm long, divided into a basal claw and an apical blade; claw ca. 0.7 mm long, ca. 0.2 mm wide, oblong, flat or lightly channeled longitudinally, margins finely erose, basally with a pair of acute, retrorse lobules; blade 1–1.2 mm long, ca. 1 mm wide, obovate, rounded, margins finely ondulate, apex decurved in natural position, basally above the claw with a pair of ca. 0.3 mm long, conic, acute, retrorse lobules; disk with a pair of obtuse lamellae below the middle. Column 1.5 mm

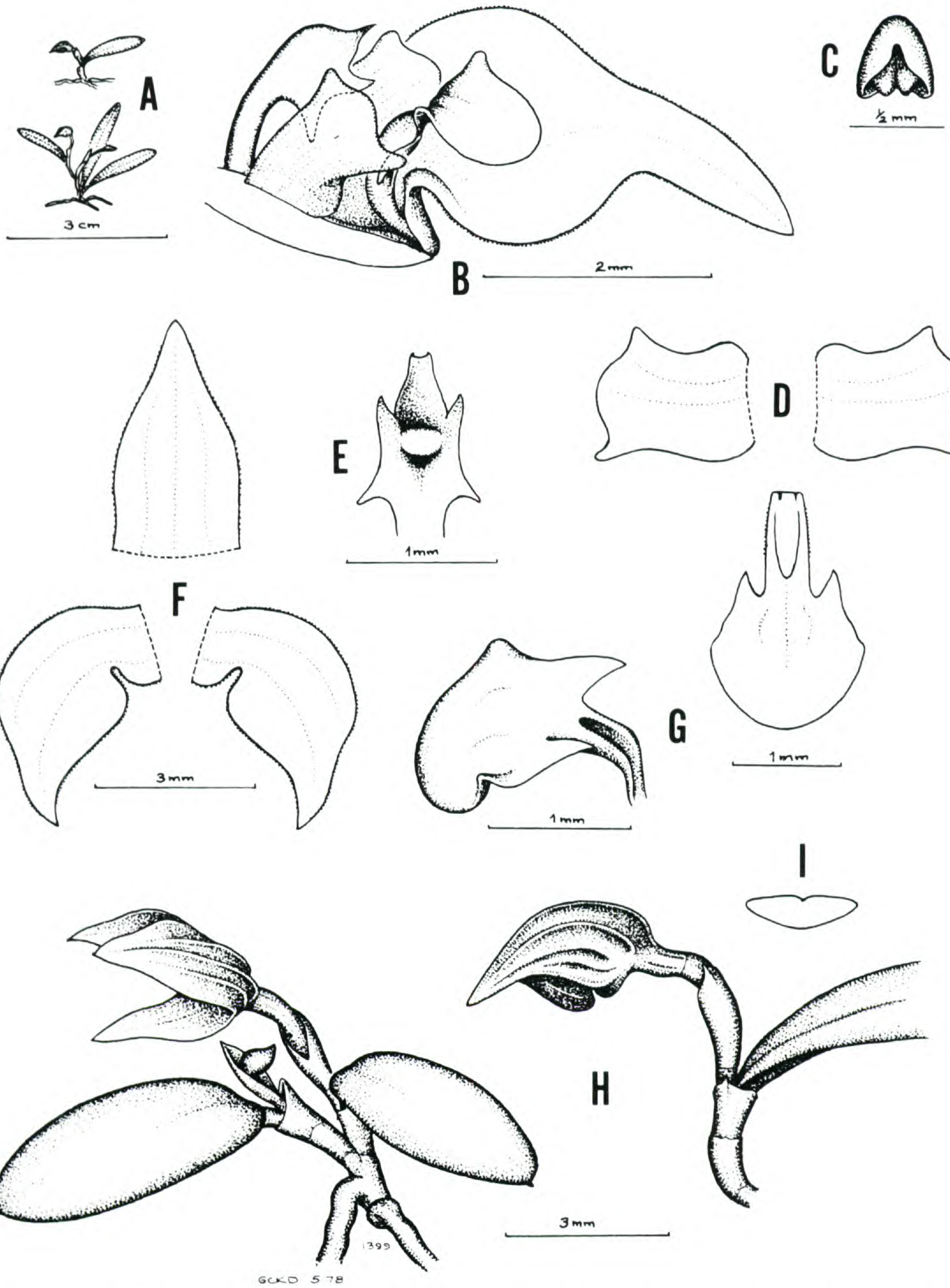

Figure 1. A–I. *Dryadella lueriana* Carnevali & G. Romero. —A. Habit. —B. Side view of flower (dorsal and left lateral sepals removed). —C. Anther and pollinia. —D. Petals, flattened. —E. Face of column. —F. Sepals. —G. Upper and lateral views of the labellum. —H. Details of habit. —I. Leaf, cross section. (Based on *Dunsterville & Dunsterville 1399*.)

long, ca. 0.8 mm wide close to the apex, longitudinally membranously winged on the distal half with a pair of acute, descencing teeth, acutely bidentate at the apex, clinandrium 3-dentate, the central tooth wider, basally produced into a ca. 1-mm-long, well-developed, channeled foot.

Dunsterville & Garay (1979) misidentified this new species as *Dryadella osmariniana*, a species from lower elevations in Amazonian Brazil that is vegetatively and florally larger. The relationships of *Dryadella lueriana* are with *Dryadella simula* (Reichb. f.) Luer from which it differs as stated in the Latin diagnosis. *Dryadella lueriana* is the second species of the genus known from the combined Guayana–Amazonas area. It is distinguished by the very small, shortly repent habit; small unspotted flowers with sepals less than 5 mm long, subquadrate petals; a tiny labellum with an obovate blade; and a winged column with a pair of acute, descending processes.

The species is named after Carlyle A. Luer, who first recognized this species as distinct from *Dryadella osmariniana*, for his outstanding contributions to the systematics of the Pleurothallidinae.

Acknowledgments. John Dwyer reviewed the Latin diagnosis. We especially thank Carlyle A. Luer for verifying identification of this new species and sharing his data on it. A scholarship from the Federated Garden Clubs of Missouri to the senior author helped make this study possible and is gratefully acknowledged.

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Six New Bamboos (Poaceae: Bambusoideae) from the Venezuelan Guayana

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The grass flora of the Guayana Highlands is a rich one and includes many poorly known bamboos (Poaceae: Bambusoideae). Twenty-one genera and 75 species of bambusoid grasses are known from the region, including the following six species newly described for the *Flora of the Venezuelan Guayana*. Judging from the intriguing sterile but as yet unidentifiable bamboo collections that remain in herbaria, more novelties may be expected from this region in the future.

Arberella venezuelae Judziewicz & Davidse, sp. nov. TYPE: Venezuela. Amazonas: Dept. Atabapo, 2 km abajo del Salto Yureba del Bajo [Río] Ventuari, 4°03′N, 66°02′W, localmente frecuente en el sotobosque, 100–120 m, 24 Mar. 1982, *F. Guánchez 1667* (holotype, MO; isotype, VEN). Figure 1.

Bambusa herbacea *Arberella bahiensis* Soderstrom & Zuloaga affinis, sed laminis longioribus (8–10.5 cm) latioribus (2.3–3.5 cm).

Caespitose perennial. Culms 40–60 cm tall, unbranched above the base; internodes glabrous or with fine, retrorse pubescence in lines; nodes slightly swollen, flaring, with a few fine, retrorse hairs. Leaves 5–7 per complement; sheaths striate, the margins finely and retrorsely hispid, the back glabrous or finely hispid, especially near the summit; ligules ca. 0.5 mm long, membranous; pseudopetioles ca. 2 mm long, turgid, brown, sparingly short-hispid; blades 8–10.5 cm long, 2.3–3.5 cm wide, lanceolate-ovate, asymmetrically cuneate at the base, acuminate at the apex, with 6–10 main nerves, the upper surface glabrous, the lower surface glabrous to puberulent, slightly whitened. Inflorescences both terminal and axillary, 3–6 produced at each node, contracted and few-flowered, the base included in the leaf sheath, up to 2 cm long, terminating in a female spikelet and bearing 3–5 short-pedicelled male spikelets below, or uncommonly, a short branchlet bearing 2 male spikelets present below. Female spikelets borne on clavate terminus of the rachis; glumes persistent, lanceolate, membranous-papyraceous, unequal, glabrous; lower glume 9–12.5 mm long, 7–9-nerved, attenuate, prolonged into a flexuous awn up to 3 mm long; upper glume 8–10 mm long, 5–7-nerved, acuminate to subaristate; floret 6–6.7 mm long, 2.3–2.5 mm wide, fusoid-ellipsoid, coriaceous, shiny, whitish; lemma with base prolonged into a squat, peglike internode 0.4–0.7 mm long, the apex acute, glabrous on the back, the margins, apex, and especially the base densely bearded with short, crisp, glassy, matted hairs; palea glabrous or with some matted hairs near the apex; lodicules 3, ca. 0.3 mm long, truncate; stigmas hispid. Caryopsis not seen. Male spikelets borne on filiform pedicels, 4–5 mm long, linear-lanceolate, hyaline, early deciduous; glumes absent; lemma 3-nerved; lodicules 3, ca. 0.3 mm long; stamens 3, the anthers 2–2.5 mm long.

Distribution. Endemic to lowland forests in the upper Río Orinoco valley, Amazonas, Venezuela.

Additional specimens examined. VENEZUELA. AMAZONAS: Dept. Atabapo, Salto Yureba, Caño Yureba, Bajo Ventuari, 4°03′N, 66°01′W, 120–150 m, 24 Oct.–4 Nov. 1981, *Delascio & Guánchez 11032* (MO); Mavaca, Alto Río Orinoco, hierba de sitios sombrios, Jan. 1970, *Aristeguieta & Lizot 7416* (NY).

Arberella Soderstrom & Calderón (Olyreae) is a rarely collected genus of six species that ranges from Costa Rica to Brazil (Rondônia and Bahia) in wet, lowland forest shade (Soderstrom & Calderón, 1979; Soderstrom & Zuloaga, 1985). Only ten collections have been made in South America. As in many genera of the Olyreae, it is difficult to delimit species due to the nearly invariant spikelet morphology, yet variable leaf blade morphology is present in different populations. Nevertheless, the three collections of the new Venezuelan species consistently have the largest leaf blades (8–10.5 cm long, 23–35 mm wide) yet seen in *Arberella*. The only other South American congeners have much smaller leaves: 4–5.5 cm long, 8–15 mm wide in *A. flaccida* (Doell)

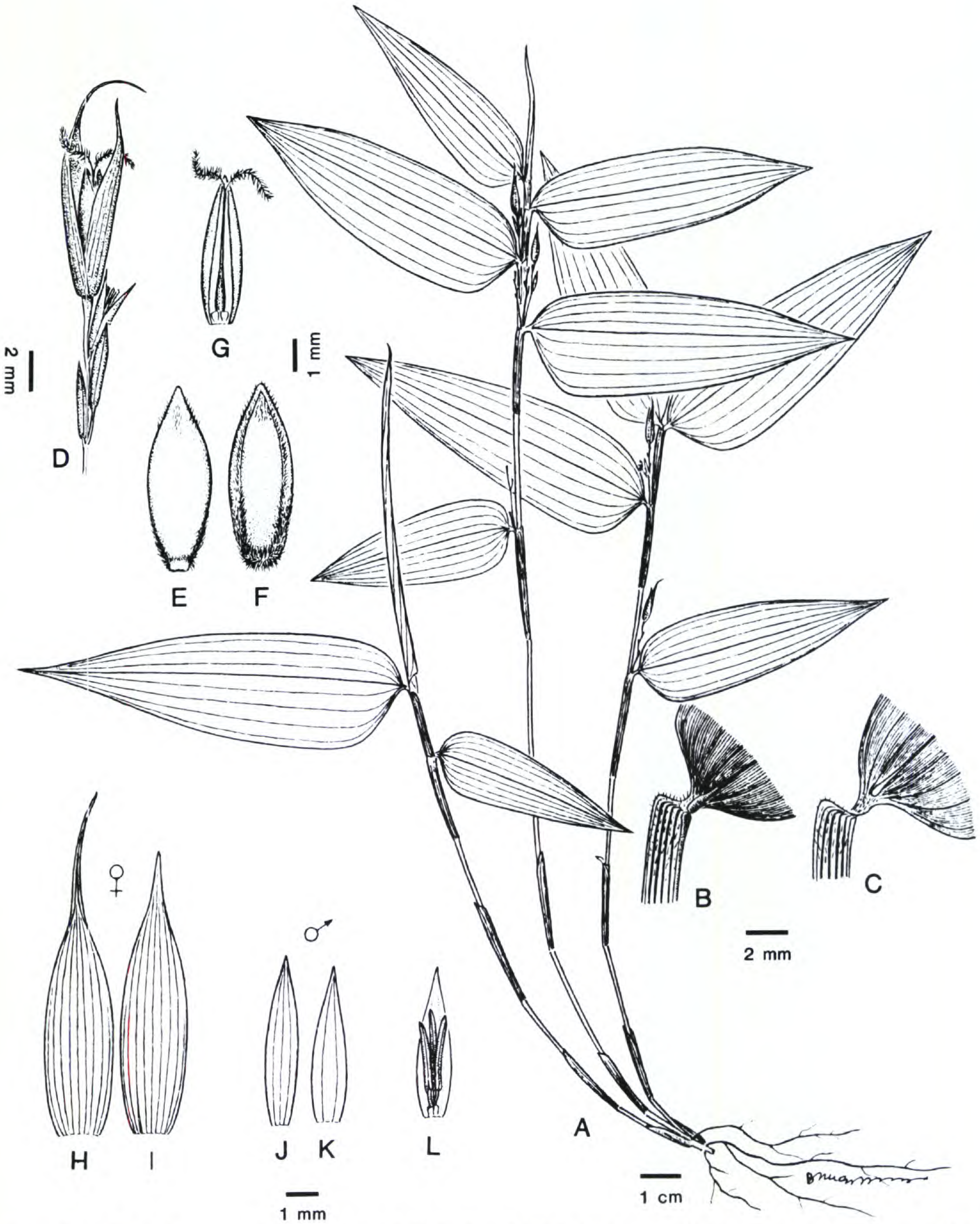


Figure 1. *Arberella venezuelae* (*Delascio & Guánchez 11032*, MO). —A. Habit. —B, C. Two views of leaf pseudopetiolar area. —D. Inflorescence showing terminal female and lateral male spikelets. E–I. Female spikelets. —E, F. Floret, dorsal and ventral views. —G. Palea with pistil, ventral view. —H, I. Glumes. J–L. Male spikelet. —J. Lemma. —K. Palea. —L. Palea with flower, ventral view.

Soderstrom & Calderón (Amazonian Colombia, the Surinam–French Guiana border, and Mato Grosso and Rondônia, Brazil), and 5–7 cm long, 17–26 mm wide in *A. bahiensis* Soderstrom & Zuloaga (Bahia, Brazil, and Amazonas, Venezuela). The Venezuelan collection (Amazonas: near Terecay on Río Manapiare, 11 Oct. 1975, *Berry 1569* (MO, NY, VEN) represents the first report of *A. bahiensis*

besides the type. The following key to the species of *Arberella* is modified from Soderstrom & Zuloaga (1985):

1a. Inflorescences produced only from lowest and uppermost nodes of the leaf complement.
  2a. Leaves 10–22 per complement; blades 4–5 cm long, 5–8 mm wide; female spikelets 9.5–11 mm long; Costa Rica ..... *A. costaricensis* (A. Hitchc.) Soderstrom & Calderón
  2b. Leaves 4–8 per complement; blades 10–14.5 cm long, 8–13 mm wide; female spikelets 18–20 mm long; Panama .... *A. lancifolia* Soderstrom & Zuloaga
1b. Inflorescences produced from all nodes of the leaf complement.
  3a. Female spikelet with rachilla internode between glumes and floret elongated; Panama ..... *A. dressleri* Soderstrom & Calderón
  3b. Female spikelet with rachilla internode between glumes and floret not elongated; South America.
    4a. Leaf blades 4–5.5 cm long, 8–15 mm wide ..... *A. flaccida* (Doell) Soderstrom & Calderón
    4b. Leaf blades 5–10.5 cm long, 17–35 mm wide.
      5a. Leaf blades 5–7 cm long, 17–26 mm wide ..... *A. bahiensis* Soderstrom & Zuloaga
      5b. Leaf blades 8–10.5 cm long, 23–35 mm wide ..... *A. venezuelae* Judziewicz & Davidse

Atractantha amazonica Judziewicz & L. G. Clark, sp. nov. TYPE: Brazil. Amazonas: Rio Marié ca. 40 km above confluence with Rio Negro, right bank beyond rapids and cachoeira, clumps at edge of river in igapó forest [ca. 0°35′S, 66°40′W], ca. 100 m, 10 Sep. 1979 (fl), *K. Kubitzki, C. E. Calderón & H.-H. Poppendieck 79-222* (holotype, INPA; isotypes, B, CANB, COL, CTES, F, G, ISC, K, LE, MO, NY, P, PE, PRE, SI, SP, TULV, US, USCH, W, WIS). Figure 2.

Bambusa lignosa, caespitosa. Culmi usque ad 6 m longi, 4–8 mm diametro, scandentes, nutantes. Laminae foliorum 10–17 cm longae, 1–1.4 cm latae. Inflorescentia racemosa, 7–15 cm longa. Spiculae 1(–2)-flosculos habentes, alterum fertilem, solitarium, alterum, cum praesenti, rudimentalem, in apice rachillae, in posteriore palea insertae; glumae 2, persistentes, membranaceae, subaristatae, prima 6–9 mm longa, 5-nervata, secunda 8–10 mm longa, 7-nervata; flosculus fertilis deciduus; lemma 18–23 mm longa, lineari-lanceolata, subfalcata, pungens, subaristata, coriacea, glabra, nitida, nervis extus vix vel haud manifestis.

Densely caespitose woody bamboo, the clumps to 1 m diam., with up to 20 culms per clump; rhizomes not seen, presumably sympodial. Culms erect at first, later scandent and pendent, climbing in vegetation to at least 6 m; internodes hollow with a small lumen, cylindrical, glabrous, smooth, 4–8 mm diam., straight and rather rigid; nodal line slightly annular, corky, dark; bud solitary, positioned about 2–4 mm above the nodal line and terminal to a slight promontory. Bud at midculm node initially producing 3 subequal, widely spreading branches, these soon rebranching so that the upper portions of the culm appear to have 20–40 branches at each node. Culm leaves papery, stramineous, glabrous, deciduous, erect, appressed to culm; sheaths 7–9 × 2 cm, rounded on the back, confluent with the base of the much smaller blade; inner ligule 0.2–0.3 mm long, very oblique, rimlike, glabrous; oral setae and outer ligule absent; blades 3–5 × 1.5 cm, triangular, acute, erect, persistent. Foliage leaves in complements of 5–9; sheaths glabrous and rounded on the back below, prominently keeled at the summit, ciliolate on the margins; inner ligule ca. 0.5 mm long, membranous, brown; outer ligule rimlike, inconspicuous; oral setae 3–6 mm long, numerous, delicate, golden brown; pseudopetioles 1.5–3 mm long, glabrous, brownish, slightly winged, sometimes deflexed; blades 10–17 cm long, 1–1.4 cm wide, linear-lanceolate, acute to obtuse above the pseudopetiole, acuminate at the apex, glabrous, the upper surface slightly scaberulous near the base, the lower surface slightly whitened, the midnerve evident only in the lower ⅓ of the blade, the margins scabrous. Peduncles 5–13 cm long, slender, glabrous. Inflorescences abundantly produced, each consisting of 1(–2) spicate racemes terminal to leafy branches; racemes 7–15 cm long, alternately bearing 8–13 loosely overlapping, short-pedicelled spikelets, often twisted so that the spikelets appear to be secundly arranged; rachis glabrous, shiny; pedicels 0.5–1 mm long, indurate, stout, shiny. Spikelets 20–28 mm long, linear-lanceolate, coriaceous, nearly glabrous, loosely appressed to or slightly divergent from the rachis, 1- or rarely 2-flowered, the lower floret functional, if present the upper floret a tiny, long-pedicelled rudiment; glumes subequal, persistent, membranous, keeled above the middle, one or both short-awned, separated by a distinct internode ca. 1 mm long; lower glume 6–9 mm long (including awn), triangular-elliptical, rounded on the back, 5-nerved, the prominent, raised midnerve prolonged into an awn 1.5–3.5 mm long; upper glume 8–10 mm long, lanceolate-ovate, 7-nerved, the apex mucronate or prolonged into an awn up to 3 mm long; rachilla internodes separating the upper glume from the lower floret 2–3.5 mm long, persistent, slightly ob-

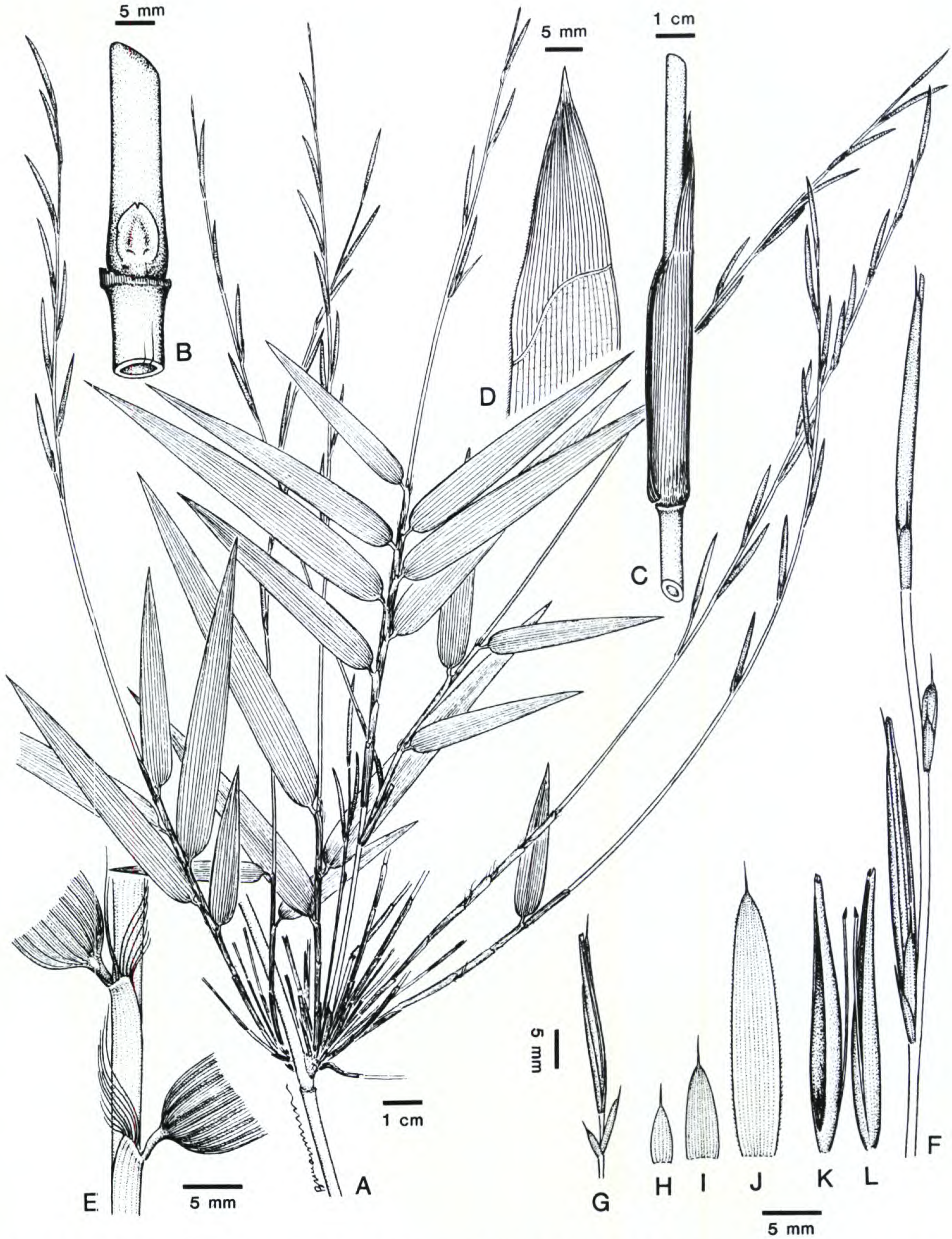


Figure 2. *Atractantha amazonica* (*Davidse & Miller 26846*, MO, except C, D, *Rubitzki et al. 79-222*, US). —A. Flowering branch complement. —B. Culm segment, showing bud. —C. Culm segment, showing leaf in situ. —D. Upper part of culm leaf. —E. Bases of foliage leaf blades, showing prominent oral setae. —F. Portion of inflorescence. —G. Spikelet, showing internode between glumes and floret. —H, I. Glumes. —J. Lemma. —K, L. Two views of palea, showing filiform rachilla prolongation and rudimentary upper spikelet.

cuneate at the apex; lower floret bisexual, 18–23 mm long, 1.2–2 mm wide, linear-lanceolate, slightly falcate, indurate, brownish, deciduous; lemma smooth, shiny, and obscurely nerved below, 7–11-nerved above with minutely ciliolate margins, the base with a squat, peglike callus ca. 0.3 mm long, the apex pungent or the midnerve abruptly prolonged into an awn up to 3 mm long; palea slightly shorter to as long as the lemma, enclosed within it or prominently protruding, linear, 4-nerved, 2-keeled, the keels ciliolate; lodicules not apparent; stamens 3, the anthers 4–10 mm long; gynoecium with ovary 1.5–2 mm long, stipitate, glabrous, the style 1, stigmas 2; rachilla internode (if present) slender, filiform, prolonged beyond the lower floret by 10–20 mm, tipped by a rudimentary spikelet up to 1.5 mm long. Mature caryopsis not seen.

Distribution and ecology. Known only from wet, lowland, seasonally flooded (igapó) forests along affluents of the Río Negro in southwestern Amazonas, Venezuela, and northwestern Amazonas, Brazil.

Additional specimens examined. VENEZUELA. AMAZONAS: Dept. Río Negro, middle part of Río Baria, margin of flooded forest around small laja, ca. 1°05′N, 66°25′ W, elev. 80 m, 29 June 1984 (most sterile, one flowering), *Davidse & Miller 26846* (AAU, ANSM, BRI, CANB, CAY, COL, F, ISC, INPA, K, L, LE, MEXU, MG, MO, NY, PRE, RB, SI, US, VEN). BRAZIL. AMAZONAS: Rio Marié, 30–40 km above confluence with Rio Negro, near Macobeta village, climbing bamboo in forest on high river banks, in sandy soil [ca. 0°35′S, 66°40′W], elev. ca. 100 m, 9 Sep. 1979 (sterile), *Kubitzki, Calderón & Poppendieck 79-209* (B, INPA, ISC, K, LE, MO, NY, P, SI, SP, TULV, USCH, US).

Atractantha McClure (Bambuseae: Arthrostylidiinae) is a genus of 3–7 species hitherto thought to be endemic to the wet forests of Atlantic coastal Brazil in the states of Bahia and Espírito Santo (McClure, 1973). Along with *Alvimia* Soderstrom & Londoño and *Elytrostachys* McClure, it is one of three arthrostylidioid genera thought to have pseudospikelets rather than true spikelets. *Atractantha amazonica* is the first species with true determinate spikelets in the genus, which joins *Raddia* Bertol. as one of only two bambusoid genera with a majority of species in eastern Brazil, and one disjunct Amazonian species.

The decision to describe this new bamboo in *Atractantha* rather than *Arthrostylidium* Rupr. may be controversial, since the presence of pseudospikelets versus true spikelets has traditionally been regarded as invariant at the generic level (McClure, 1973; Soderstrom & Ellis, 1987). However, it is possible that, by reduction, true spikelets may have evolved several times from pseudospikelets, and we choose to emphasize the distinctive and presumably uniquely derived floret morphology shared by both the new species and previously described species of *Atractantha*. In all of them, each spikelet is 1- or occasionally 2-flowered, with a large, slender, spindlelike, falcate, indurate, obscurely nerved, pungent, brownish, functional lower floret, and if present, a tiny, rudimentary upper floret borne on an elongate, bristlelike prolongation of the rachilla. *Arthrostylidium* and *Atractantha* have very similar vegetative branching patterns in which a promontory produces numerous small branchlets. As traditionally conceived, *Arthrostylidium* has 3- to many-flowered spikelets lacking the specialized morphology of *Atractantha*.

A speculative hypothesis to explain the relationships between these genera is the following. The common ancestor of both genera had the distinctive promontoried branch-complement and inflorescences with many-flowered pseudospikelets with undifferentiated florets similar to those of *Guadua* Kunth. Two lines diverged, one leading to *Arthrostylidium*, which evolved true spikelets from pseudospikelets, the other leading to *Atractantha* (and perhaps also *Alvimia*), which first developed the distinctive spindle-shaped floret morphology while retaining the pseudospikelets (eastern Brazilian species of the genus). One offshoot of this line (*A. amazonica*) developed true spikelets, probably by reduction. Still, it is recognized that more anatomical and molecular data needs to be gathered on all the genera and monophyletic species groups within the Arthrostylidiinae before *A. amazonica* can be placed with certainty.

Aulonemia chimantaensis Judziewicz & Davidse, sp. nov. TYPE: Venezuela. Bolívar: Dist. Piar, altiplanicie en la base meridional de los farallones superiores del Apacará-tepui, "drier part of savanna bordering large swampy savanna," 5°20′N, 62°12′W, ca. 2,200 m, 30 Jan.–1 Feb. 1983 (fl), *J. A. Steyermark, O. Huber & V. Carreño 128369* (holotype, MO; isotypes, ISC, K, SP, US, VEN). Figure 3G–J.

Culmi usque ad 1.5 m longi, erecti. Vaginae foliorum glabrae vel strigosae, fimbriatae ad apicem tantum; fimbriae 1–2 cm longae; laminae foliorum 11–14 cm longae, 1.3–2.5 cm latae, lanceolatae. Inflorescentia paniculata, 22–28 cm longa, ampla. Spiculae (1.3–)2.2–4 cm longae, 9–15-flosculos fertiles continentes; glumae purpureae, prima 1.5–2.7 mm longa, lanceolata, acuta, 1-nervata, secunda 3–4.5 mm longa, ovata, obtusa, 3- vel 5-nervata; lemmata fertilia (6–)8–10 mm longa, ovata vel elliptica, obtusa, tridentata, 7-nervata, viridescentia.

Woody bamboo; culms to 1.5 m long, erect, smooth. Culm leaves not seen. Midculm nodes bear-

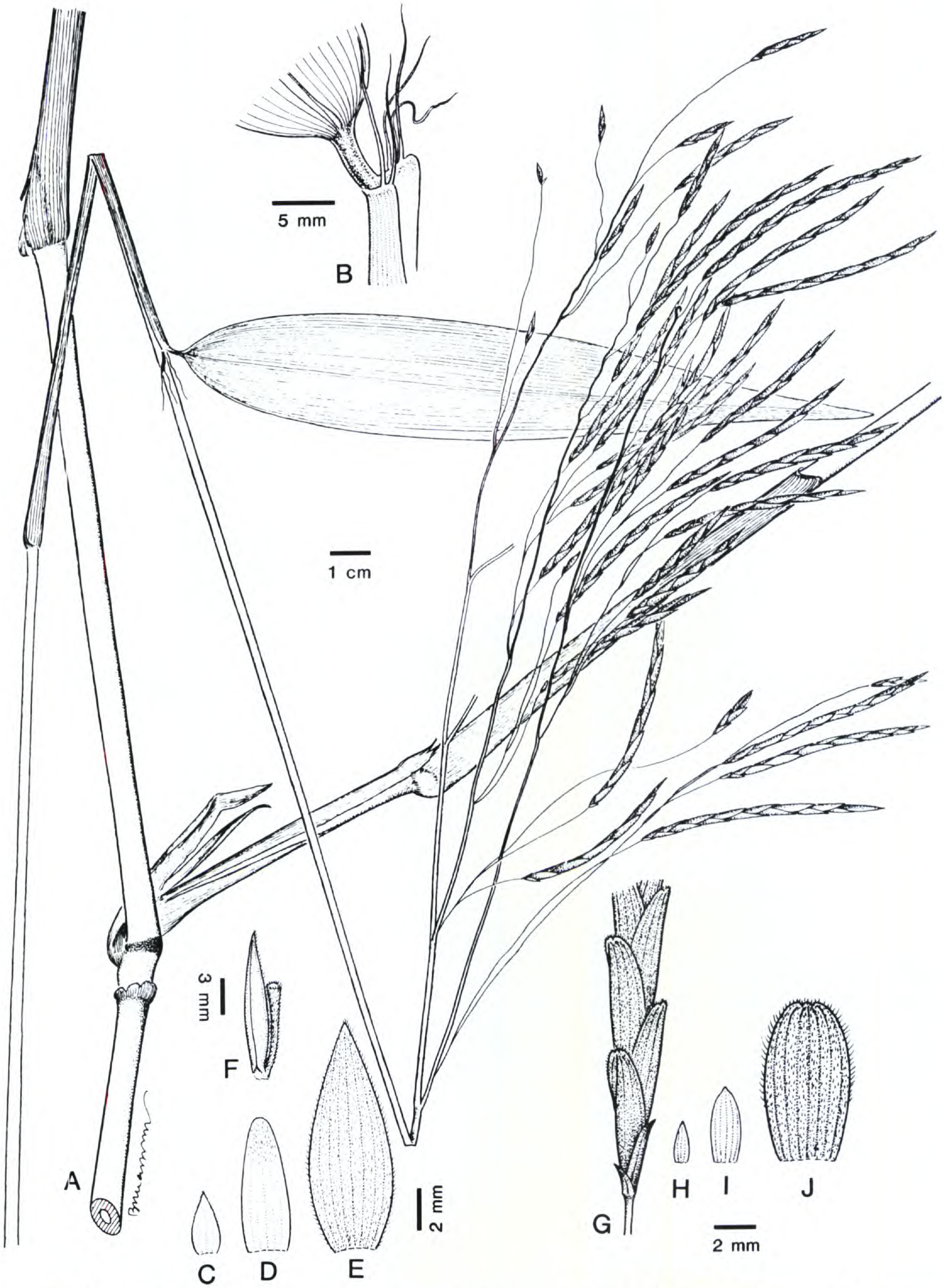


Figure 3. New species of *Aulonemia*. A–F. *A. jauaensis* (*Steyermark 98093*, MO). —A. Portions of flowering culm. —B. Foliage leaf blade base and sheath summit. —C. Lower glume. —D. Upper glume. —E. Lemma. —F. Floret and attached rachilla internode. G–J. *A. chimantaensis* (*Huber & Steyermark 7037*, MO). —G. Lower portion of spikelet. —H. Lower glume. —I. Upper glume. —J. Slightly tridentate lemma.

TABLE 1. Comparison of *Aulonemia jauaensis* with *A. chimantaensis*.

	A. jauaensis	*A. chimantaensis*
Leaf blade length (cm)	15–20	11–14
Leaf blade width (cm)	3–4.5	1.5–3.5
Spikelet length (mm)	20–70	13–40
Florets per spikelet	(5–)11–23	9–15
Lower glume length (mm)	2.5–3.5	1.5–2.7
Upper glume length (mm)	5–6	3–4.5
Functional lemma length (mm)	10–13	6–10
Functional lemma apex	acute	obtuse, often slightly tridentate
Lemma indument (dorsal)	± densely covered with straggling, glassy hairs	glabrous or thinly covered with straggling, glassy hairs

ing single, divergent branches. Foliage leaves with sheaths glabrous below, strigose on the back near the summit; oral setae 1–2 cm long, brown, few, restricted to the summit; outer ligule 0.3 mm long, indurate; inner ligule ca. 1 mm long, membranous; pseudopetioles 4–6 mm long, dark purple; blades 11–14 cm long, 1.5–3.5 cm wide, often deflexed, narrowly to broadly lanceolate, obtuse at the base, acuminate at the apex, glabrous above, puberulent and scaberulous beneath, the margins with scattered prickles. Peduncle 5–15 cm long, slender, antrorsely scabrous. Inflorescence 22–28 cm long, an open, ovoid panicle; branches 6–10 cm long, loosely ascending, slender. Spikelets (1.3–)2.2–4 cm long, 1.8–2.5 mm wide, linear, slightly curving, densely 9–15-flowered, the florets imbricate; glumes purplish, firmly membranous, glabrous; lower glume 1.5–2.7 mm long, lanceolate, acute, slightly recurved, 1-nerved; upper glume 3–4.5 mm long, ovate, obtuse, 3–5-nerved; lowest floret sterile, purplish, consisting of only a lemma, this 4.5–6 mm long, ovate, acute, 3–5-nerved; functional florets with lemmas (6–)8–10 mm long, 1.5–2 mm wide (folded width), ovate, obtuse to slightly tridentate, 7-nerved, greenish, glabrous on the back or thinly covered with straggling, glassy hairs 0.2–0.3 mm long, the margins with short, spreading cilia; paleas 7–9 mm long, 1.5 mm wide between the ciliolate keels, nearly as long as but still concealed by the lemma, slightly notched at the apex; rachilla internodes 2–3 mm long, ca. 0.5 mm wide; lodicules 3, 0.9–1 mm long, spatulate, hyaline, several-nerved, short-pilose at the apex; stamens 3, the anthers 2.5–3.3 mm long, yellow; gynoecium not seen. Fruit not seen.

Distribution. Known only from the summit of Apacará-tepui, Chimantá Massif, Bolívar, Venezuela.

Additional specimens examined. VENEZUELA. BOLÍVAR: Dist. Piar, Chimantá Massif, altiplanicie en la base meridional de los farallones superiores del Apacará-tepui, frecuente en matorral en el fondo del valle, 5°20′N, 62°12′W, ca. 2,200 m, 30 Jan.–1 Feb. 1983 (fl), *Huber & Steyermark 7037* (MO, VEN); Dist. Piar, altiplanicie en la base meridional de los farallones superiores del Apacará-tepui, "drier part of savanna bordering large swampy savanna," 5°20′N, 62°12′W, ca. 2,200 m, 30 Jan.–1 Feb. 1983 (fl), *Steyermark et al. 128370* (MO); Chimantá Massif, sección SE del Apacará-tepui, 5°19′N, 62°07′W, ca. 2,150 m, 6–9 Feb. 1984 (st), *Huber, Colella & Vareschi 8905* (MO, US).

Aulonemia Goudot (Bambuseae: Arthrostylidiinae) is a genus of about 30 described and several undescribed species that ranges from southern Mexico and northern South America to Bolivia and southern Brazil, at 500 to 3,500 m. It is usually characterized by a branching pattern with one large branch dominant at each midculm node; foliage leaves with prominent oral setae and broad, deflexed blades; and open panicles of slender spikelets. Both *A. chimantaensis* and the following species (*A. jauaensis*) appear to be distinctive within the genus because of their very long spikelets with contrasting purple glumes and numerous, greenish, densely imbricate florets. Table 1 summarizes the differences between the two new species.

Two other species of *Aulonemia* have previously been described from the Guayana Highlands: *A. deflexa* (N. E. Brown) McClure (Mt. Roraima, Ilu-tepui) and *A. steyermarkii* (McClure) McClure (Ptari-tepui, Ilu-tepui, and Mt. Roraima). Both differ from *A. chimantaensis* and *A. jauaensis* in their smaller, fewer and more loosely flowered, purple spikelets less than 2 cm long. Also, sterile collections of at least four more species of *Aulonemia* from the Guayana Highlands have been examined, but all have distinctive vegetative features that make them un-

likely to be closely related to *A. chimantaensis* and *A. jauaensis*.

Aulonemia jauaensis Judziewicz & Davidse, sp. nov. TYPE: Venezuela. Bolívar: Cerro Jaua, cumbre de la porción Central-Occidental de la Meseta, 4°45′N, 64°26′W, 60 km NW de la misión de Campamento Sanidad del Río Kanarakuni, 1,922–2,100 m, 22–27 Mar. 1967 (fl), *J. A. Steyermark 98093* (holotype, US; isotypes, F, NY). Figure 3A–F.

Culmi usque ad 1 cm diametro, 10 m longi, scandentes. Vaginae foliorum glabrae, fimbriatae ad apicem tantum; fimbriae 1–2 cm longae; laminae foliorum 15–20 cm longae, 3–4.5 cm latae, lanceolato-ovatae. Inflorescentia paniculata, 25–30 cm longa, ampla. Spiculae (2–)4–7 cm longae, (5–)11–23-flosculos fertiles continentes; glumae purpureae, prima 2.5–3 mm longa, 1– vel 3-nervata, secunda 5–6 mm longa, 5– vel 7-nervata; lemmata fertilia 10–13 mm longa, ovata, acuta, 7– vel 9-nervata, viridescentia.

Slender, scandent woody bamboo; culms up to 10 m long, 1 cm diam., glabrous, smooth, with a lumen ca. ⅓ the diameter of the culm. Culm leaves not seen. Midculm nodes bearing single, stout, divergent branches each bearing a prophyll 3–4 cm long. Foliage leaves with sheaths (including margins) glabrous; oral setae 1–2 cm long, brown, few, restricted to the sheath summit; outer ligule 0.3 mm long, rimlike; inner ligule 0.5–0.7 mm long, membranous; pseudopetioles 3–6 mm long, dark purple; blades 15–20 cm long, 3–4.5 cm wide, lanceolate-ovate, acute to obtuse at the base, acuminate at the apex, slightly lighter beneath, glabrous or finely scabrid-puberulent beneath. Peduncle 25–30 cm long, slender. Inflorescence 25–30 cm long, an open, ovoid panicle; branches 8–12 cm long, loosely ascending, slender, stiff, scaberulous. Spikelets (2–)4–7 cm long, 2–3.5 mm wide, linear, slightly curving, the bracts ± densely covered throughout with straggling, glassy hairs 0.2–0.3 mm long, densely (5–)11–23-flowered, the florets imbricate; glumes purplish, firmly membranous; lower glume 2.5–3 mm long, lanceolate, acute, slightly recurved, 1–3-nerved; upper glume 5–6 mm long, ovate, acute to obtuse, 5–7-nerved; lowest floret sterile, consisting only of a lemma, this 7–8 mm long, ovate, acute, 3–5-nerved; functional florets with lemmas 10–13 mm long, ca. 2 mm wide (folded width), ovate, acute, 7–9-nerved, greenish; paleas concealed by the lemmas, 7–8 mm long, 1.5 mm wide between the ciliolate keels, slightly notched at the apex; rachilla internodes 3–4 mm long, ca. 0.5 mm wide; lodicules, androecium, gynoecium, and fruit not seen.

Distribution. Known only from the type collection on the summit of Cerro Jaua, Bolívar, Venezuela.

This species is apparently closely related to the also newly described *Aulonemia chimantaensis;* the two are compared in Table 1.

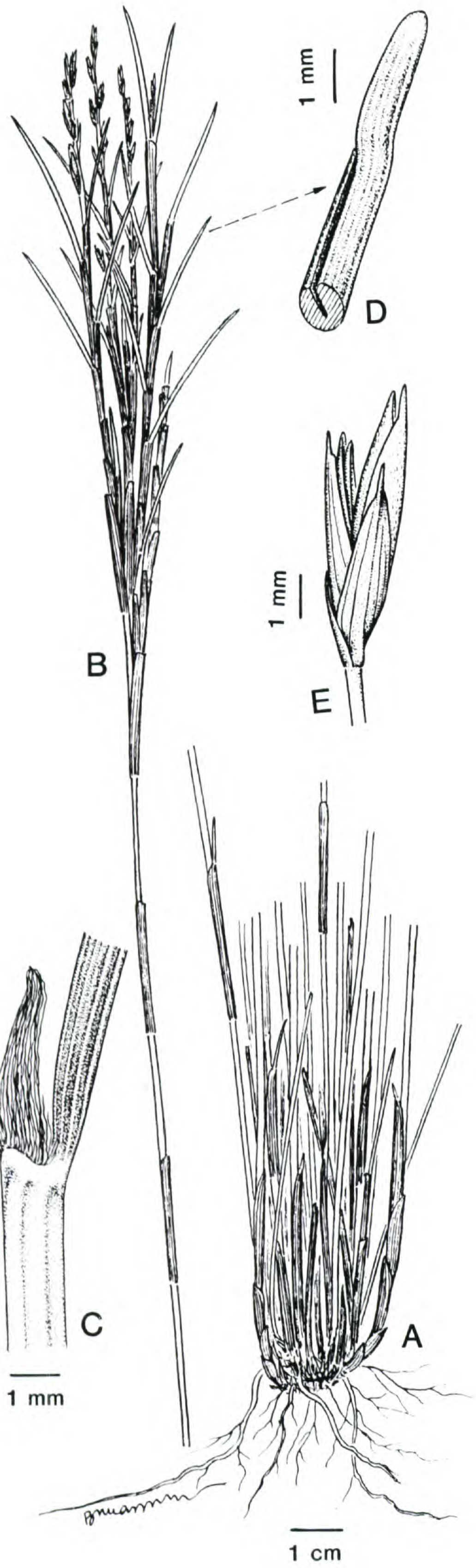
Myriocladus involutus Judziewicz & Davidse, sp. nov. TYPE: Venezuela. Bolívar: Dept. Piar, Chimantá Massif, frequent, rocky escarpment between W and E branches of the headwaters of the Río Tirica, 2,260 m, 13 Feb. 1955 (fl), *J. A. Steyermark & J. J. Wurdack 819* (holotype, NY; isotype, F). Figure 4.

Bambusa lignea humilis *Myrioclado steyermarkii* Swallen affinis, sed laminis longioribus (4.5–6.5 cm) angustioribus (0.7–1.5 mm) involutis differt.

Dwarf woody bamboo up to 1 m tall forming dense colonies by short, pachymorph rhizomes. Culms erect, unbranched below, glabrous; internodes 2.5–8 cm long in lower portion of culm, gradually shortening to 0.5 cm in upper portion. Leaves with sheaths broadest near summit (folded width 2 mm), glabrous, smooth, shiny, apparently glaucous, rounded to somewhat keeled on the back; inner ligule 0.1 mm long, ciliolate; outer ligule a minute rim; oral setae apparently represented by a dense mat of 3–5-mm-long, very fine, white, matted cilia; pseudopetiole ca. 1 mm long; blades strongly ascending, 4.5–6.5 cm long, 0.7–1.5 mm wide (rolled width), involute, glabrous, glaucous, the apex obtuse. Culms often rebranching in upper portion of leaf complement, each branch terminating in an inflorescence; inflorescence a spicate raceme 2.5–3.5 cm long bearing 4–7 spikelets, the rachis angled, glabrous, scabrous. Spikelets 7–8 mm long, dark purplish brown, with scattered minute, stiff hairs; lower glume 2–2.5(–3.5) mm long, lanceolate-ovate, obtuse to acute; upper glume 3.2–4(–5.5) mm long, lanceolate, 1(–3)-nerved, the midnerve prominent and slightly excurrent; lowest floret 4.5–5 mm long, lanceolate, sterile, lacking a palea or flower; fertile florets 2, 6–7 mm long, lanceolate; rachilla prolonged 2 mm past upper fertile floret and bearing a rudimentary spikelet 3 mm long; lodicules, androecium, and gynoecium not seen. Caryopsis 4 × 1 mm, pyriform, acute, dark purplish brown, terete; hilum linear; embryo 0.6 mm long, basal.

Distribution. Endemic to the summit of Apacará-tepui, Chimantá Massif, Bolívar, Venezuela.

Additional specimen examined. VENEZUELA. BOLÍVAR: Chimantá Massif, valle amplio ubicado en la sección SE de Apacará-tepui, 5°19′N, 62°07′W, 2,150



m, estéril, 6–9 Feb. 1984, formando densas colonias en el estrato herbáceo en comunidades de *Chimantaea mirabilis*, *Huber, Colella & Vareschi 8858* (MO, MYF, NY, US).

Myriocladus Swallen (Bambuseae: Arthrostylidiinae) is a genus of 13 species endemic to the upper slopes and summits of tepuis in southern Venezuela and adjacent Brazil (Soderstrom et al., 1988). This new species, named for its very narrow, involute leaf blades, is apparently most closely related to *M. steyermarkii*, which differs in its larger, flat leaf blades 1–3 cm long and 1.5–3.5 mm wide, and in the absence of fine, white, matted oral setae at the summit of the leaf sheath. Both species are unusual in the genus in their dwarf stature, equal-sized culm internodes, and small, few-flowered, racemose inflorescences. *Myriocladus steyermarkii* (including *M. gracilis* Swallen, here regarded as a synonym) is a commoner species known from over a dozen collections at 1,900 to 2,500 m on Chimantá Massif.

Steyermark & Wurdack 819 is a mixed collection. The US sheet is the holotype of *M. steyermarkii* Swallen and closely matches the author's description and illustration; however, the F and NY specimens are *M. involutus*.

Rhipidocladum sibilans Davidse, Judziewicz, & L. G. Clark, sp. nov. TYPE: Venezuela. Anzoátegui: Dist. Libertad, road from El Vigia to Buenos Aires, 10°01′N, 64°13′W, 1,000 m, 27 Nov. 1981, *G. Davidse & A. C. González 19490* (holotype, MO; isotypes, COL, ISC, K, MEXU, US, VEN). Figures 5, 6.

Bambusa lignosa; culmi 4–8 m longi, cylindrati, cavi, ad 1.5 cm diametro. Ramuli floriferi 150–200 in quoque nodum, 11–18(–35) cm longi; folia ramulorum 5–7; laminae 5–7 cm longae, 1.8–2.7(–3.5) mm latae, lineare, planae. Inflorescentia racemosa, tenua. Spiculae 2–3, 2–4 cm longae; gluma prima 5–10 mm longa; secunda 8–14 mm longa, arista 4–6 mm longa; lemmata sterilia 2, 11–13 mm longa, aristae 4–6 mm longae; lemma fertile glabra, 7–15-nervata, arista 4–6 mm longa; flosculi rudimentarii 3(–4).

Caespitose woody bamboo. Culms 4–8 m tall, to 1.5 cm diam., smooth, shiny, hollow, weak, the walls ca. 1 mm thick. Culm leaves with sheaths ca. 10 cm long, 6–7 cm wide at the base, erect, clasping the culm, narrowly triangular, abaxially glabrous, adaxially sparsely pubescent above, densely pubescent basally, or occasionally glabrous. Midculm nodes

←

Figure 4. *Myriocladus involutus* (*Steyermark & Wurdack 819*, NY). —A. Plant base. —B. Flowering shoot. —C. Leaf ligular region. —D. Apex of leaf blade. —E. Spikelet.

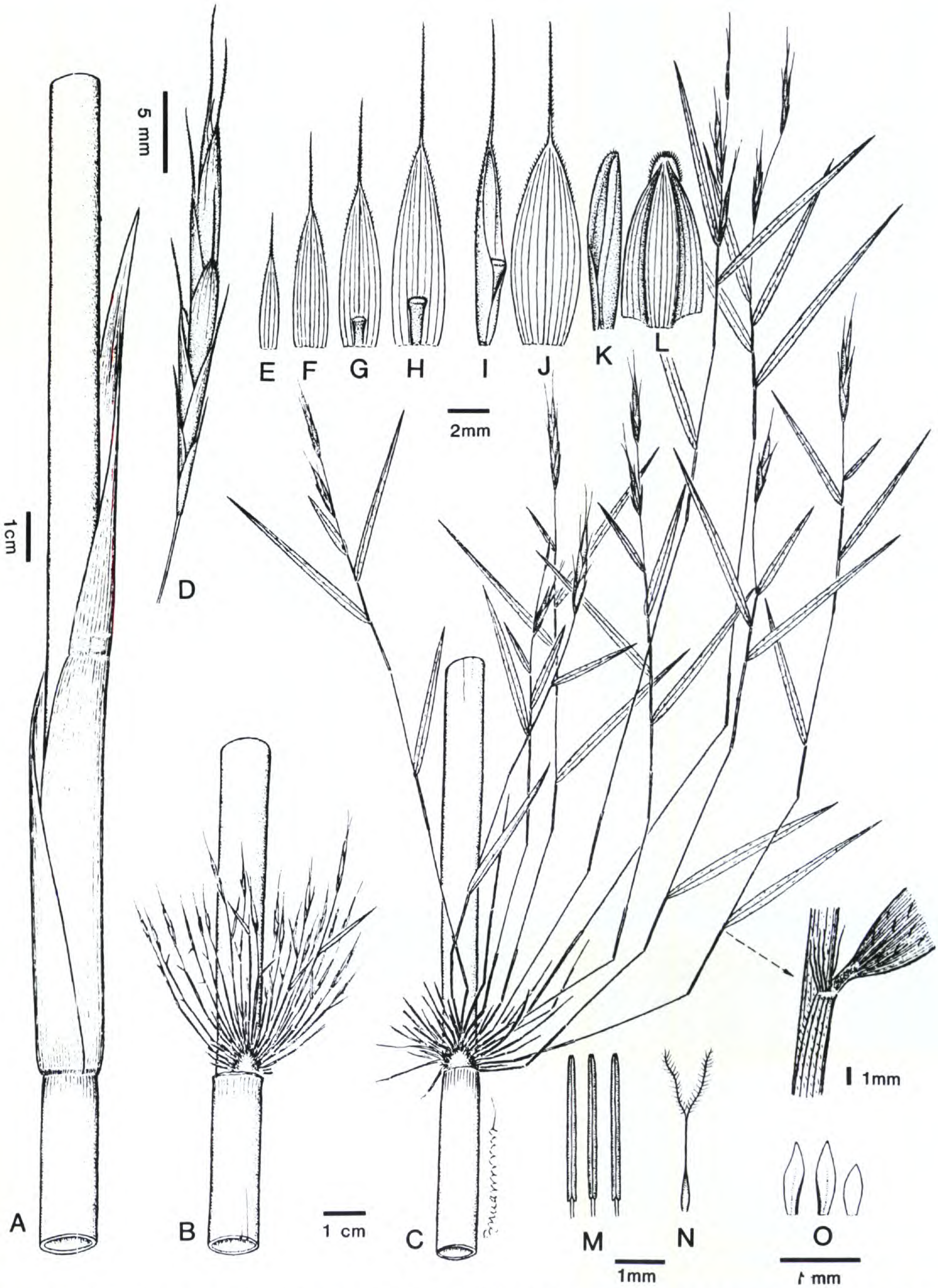


Figure 5. *Rhipidocladum sibilans* (*Davidse & González 19490*, MO). —A. Culm with leaf in situ. —B. Flowering young branch complement. —C. Flowering mature branch complement. —D. Spikelet. —E, F. Glumes. —G, H. Sterile florets. —I, J. Functional lemmas. —K, L. Palea. —M. Stamens. —N. Gynoecium. —O. Lodicules.

Figure 6. Habit of *Rhipidocladum sibilans* at type locality in Anzoátegui, Venezuela (*Davidse & González 19490*); note the young shoots in the foreground.

with 150–200 subsidiary branches per complement; subsidiary branches 11–18 cm long (to 35 cm long on some flowering branches), 1–1.5 mm wide, smooth, the distal portion clothed in bladeless sheaths, these sparingly to densely pubescent, especially on the margins, the apical portions less pubescent, bearing a complement of 5–7 blades. Foliage leaves with sheaths nearly glabrous to densely puberulent, especially on the margins; outer ligule minute; inner ligule less than 0.2 mm long, membranous; oral setae 1–3 mm long, few, delicate; pseudopetioles 0.7–1.3 mm long, nearly glabrous; blades 5–7 cm long, 1.8–2.7(–3.5) mm wide (occasionally 2 cm long and 1.5 mm wide on some flowering branches), linear, flat, the upper surface glabrous, the lower surface glabrous to short-pilose, the margins scabrous near the apex. Inflorescences terminating leafy subsidiary branchlets, 5–8 cm long, slightly curving, bearing 2–3 ascending, subsessile spikelets on pedicels with densely pubescent apices. Spikelets (including awns) 2–4 cm long, 4–7-flowered, terete, the bracts all bearing scabrous awns 4–6 mm long; glumes stramineous, the lower 5–10 mm long (including awn), linear-lanceolate, the upper 8–14 mm long, lanceolate; upper glume separated from lower sterile floret by an internode ca. 8 mm long; sterile florets 2, 11–13 mm long, lanceolate, 5–7-nerved, the nerves obscure at the base, prominent at the puberulent apex; functional florets 2(–3), 12–15 mm long, light green mottled with darker spots, scabrous; lemmas lanceolate, 7-nerved, pubescent at the apex, the margins near the base overlapping, ciliolate; paleas nearly as long as the lemmas, 4-nerved, 2-keeled; lodicules 3, narrowly ovate, acuminate, glabrous, obscurely several-nerved, the posterior 0.7 mm long, the anterior pair 0.9 mm long; stamens 3, the anthers 2.5–3 mm long, linear; gynoecium with ovary glabrous, style 1, stigmas 2, hispid; rachilla internodes 3–4 mm long, puberulent, the apex cupulate, ciliate; 3(–4) uppermost florets progressively reduced and sterile, all awned. Fruit not seen.

Distribution and ecology. Endemic to eastern Venezuela (Anzoátegui, Bolívar, and Sucre), and perhaps adjacent Guyana, in forests or at forest margins from 900 to 1,220 m. The type was collected from a population in which all plants were in flower.

Additional specimens examined. VENEZUELA. ANZOÁTEGUI: Dist. Bolívar, just S of El Zamuro, Fila El Purgatorio, 10°02′N, 64°17′W, 1,100 m, 24 Nov. 1981 (fl), *Davidse & González 19305* (ISC, MO, US, VEN). BOLÍVAR: Gran Sabana, ca. 10 km SW of Karaurín, at junction of Ríos Karaurín and Asadón (Río Sanpa), streambank in forest, 5°19′N, 61°03′W, 900–1,000 m, 26 Apr. 1988 (st), *Liesner 23869* (COL, ISC, K, MO, TULV, US, VEN); along Río Karuai, at base of Sororopántepui, W of La Laja, 1,220 m, 29 Nov. 1944 (st), *Steyermark 60759* (F, US); "Arapoo" River, Mt. Roraima Expedition [perhaps in Guyana], Oct. 1884 to Jan. 1885 (st), *Im Thurn 18* (BRG, US). SUCRE: Los Altos, Jan. 1942 (st), *Tamayo 2124* (US).

The very sparsely flowered, nonsecund inflorescences with slender, terete, awned spikelets of the new species are unusual in *Rhipidocladum* McClure (Arthrostylidiinae), a widespread but tropical American genus of about 20 species (McClure, 1973).

The closest relative of *R. sibilans* appears to be *R. panamense* R. W. Pohl, a Panamanian endemic (Pohl, 1985). Both taxa have extremely narrow leaf blades, but *R. sibilans* differs from the latter species in its fewer-flowered (2–3 vs. 5–7) inflorescences with longer (2–4 cm vs. 1.2–1.6 cm), more slender spikelets. Vegetatively the two species are similar, and some sterile Colombian material (e.g., *Pennell & Killip 8320*, US) cannot be definitely named.

Julian A. Steyermark noted on the label of his collection number 60759 that the local name for this bamboo is *murok-wayi-yek*, and that Amerindians manufacture whistles about 25 cm long and

7 mm diam. from the hollow culm internodes. The specific epithet is derived from the Latin *sibilus* (pipe or whistle), and alludes to this use.

Acknowledgments. This work was completed at the Missouri Botanical Garden as part of the *Flora of the Venezuelan Guayana* project. We thank Bruno Manara for the illustrations and assistance with the Latin descriptions, the curators of F, NY, US, and VEN for loans of herbarium material, and Paul E. Berry and an anonymous reviewer for critically reading the manuscript.

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Eight New Species of Tree Ferns (*Cyathea*, Cyatheaceae) from the American Tropics and Three New Combinations

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The new species described herein are a result of my work on the pteridophyte volume for *Flora Mesoamericana* and on general fern identifications at MO. In the descriptions, all mention of indument refers to that found on the abaxial surface of the leaf unless otherwise stated.

Cyathea albomarginata R. C. Moran, sp. nov. TYPE: Costa Rica. Heredia: NW slope of Volcán Barva, between Laguna del Barva and base of Cerros Las Marías, 2,450–2,800 m, *Grayum 7469* (holotype, MO; isotypes, CR not seen, UC). Figure 1.

Petiolus brunneus sine spinis, squamellis albis minutis, squamis ex late ovato lanceolatis, bicoloribus, atropurpureis marginibus latis albis; pinnulae 10–12 × 1.2–1.5 cm; costulae squamosae, squamis ex circulari ovatis; venae semel furcatae; sori inframediani, secus costulam dispositi, paraphysibus inconspicuis; indusia inconspicua squamiformia.

Trunk ca. 0.5 m tall; petiole brown, not spiny; petiole scales 7–12 × 4–6 mm, ovate to lanceolate, sharply bicolorous, purplish brown with wide white borders; petiole scurf consisting of dense white squamellae; lamina 2-pinnate-pinnatifid, tapered to the apex; pinnae stalked, the stalk 2.5–4 cm long; pinnules 10–12 × 1.2–1.5 cm, short-stalked, the stalk 1–5 mm long; ultimate segments ca. 3 mm wide, entire or serrulate apically; rachis, costae, and costules lacking hairs but with whitish scurf, sparsely scaly, the scales circular to ovate, golden brown, flat or subbullate; veins 1-forked, 5 or 6 pairs per segment, with appressed inconspicuous scurf; laminar tissue between the veins glabrous; sori inframedial, crowding the midribs; paraphyses shorter than the sporangia, inconspicuous; indusium hemitelioid.

Paratype. PANAMA. BOCAS DEL TORO: headwaters of Río Colubre, Colubre Camp, 2,400–2,550 m, *Gómez et al. 22370* (CR, MO, UC).

This species grows in wet forests from 2,400 to 2,800 m, which is a higher elevational range than most species of *Cyathea*. It differs from all other *Cyathea* in Mesoamerica by the broad, white-margined petiole scales (Fig. 1c) and white scurf. The aerophores at the bases of the pinnae and pinnules are frequently elongated and darkened, resembling an abscission layer, but the pinnae and pinnules do not appear to disarticulate. The minute, scalelike indusium is easily overlooked. This species is quite distinct, and I am not sure to which species it is most closely related.

Cyathea nodulifera R. C. Moran, sp. nov. TYPE: Panama. Veraguas: Cerro Tute, ca. 2 km N of Santa Fé, along ridge trail to summit, N of Escuela Primaria Alto de Piedra, 900–1,000 m, *Moran 4030* (holotype, MO; isotypes, PMA, UC, US). Figure 2.

Petiolus atropurpureus spinosus, squamis lanceolatis, brunneis centro fusciore ornatis; petioluli pinnarum 3–5 cm longi; pinnulae 15–23 × 2.5–3.5 cm, petiolulatae, petiolulis 6–10 mm longis, basi tuberculatis; rhachis et costae atropurpureae; venae semel furcatae, utrinque glabratae; sori inframediani, paraphysibus inconspicuis; indusia nulla.

Trunk to ca. 0.5 m tall; petiole atropurpureous, spiny, the spines 1–5 mm long, slender; petiole scales 10–20 × 2–3 mm, dark brown medially with lighter brown borders, narrowly lanceolate; petiole scurf consisting of dense brown squamellae; lamina 2-pinnate-pinnatisect, the apex abruptly or gradually reduced, pinnatifid; pinnae ca. 12 pairs, stalked, the stalk 3–5 cm long; pinnules 15–23 × 2.5–3.5 cm, stalked, the stalk 6–10 mm long, with a raised tubercle(s) at the juncture with the costa (Fig. 2d); ultimate segments 5–6 mm wide, 15–20 pairs per pinnule, serrate to crenate-serrate; rachis, costae, and costules lacking spines, atropurpureous, lacking hairs and scales, scurf present; costules and midribs of the ultimate segments scaly, the scales flat to subbullate, circular to ovate-acuminate, golden, finely erose-denticulate; veins 1-forked, 6–9 pairs per segment, glabrous; laminar tissue between the veins glabrous; sori inframedial; paraphyses shorter than

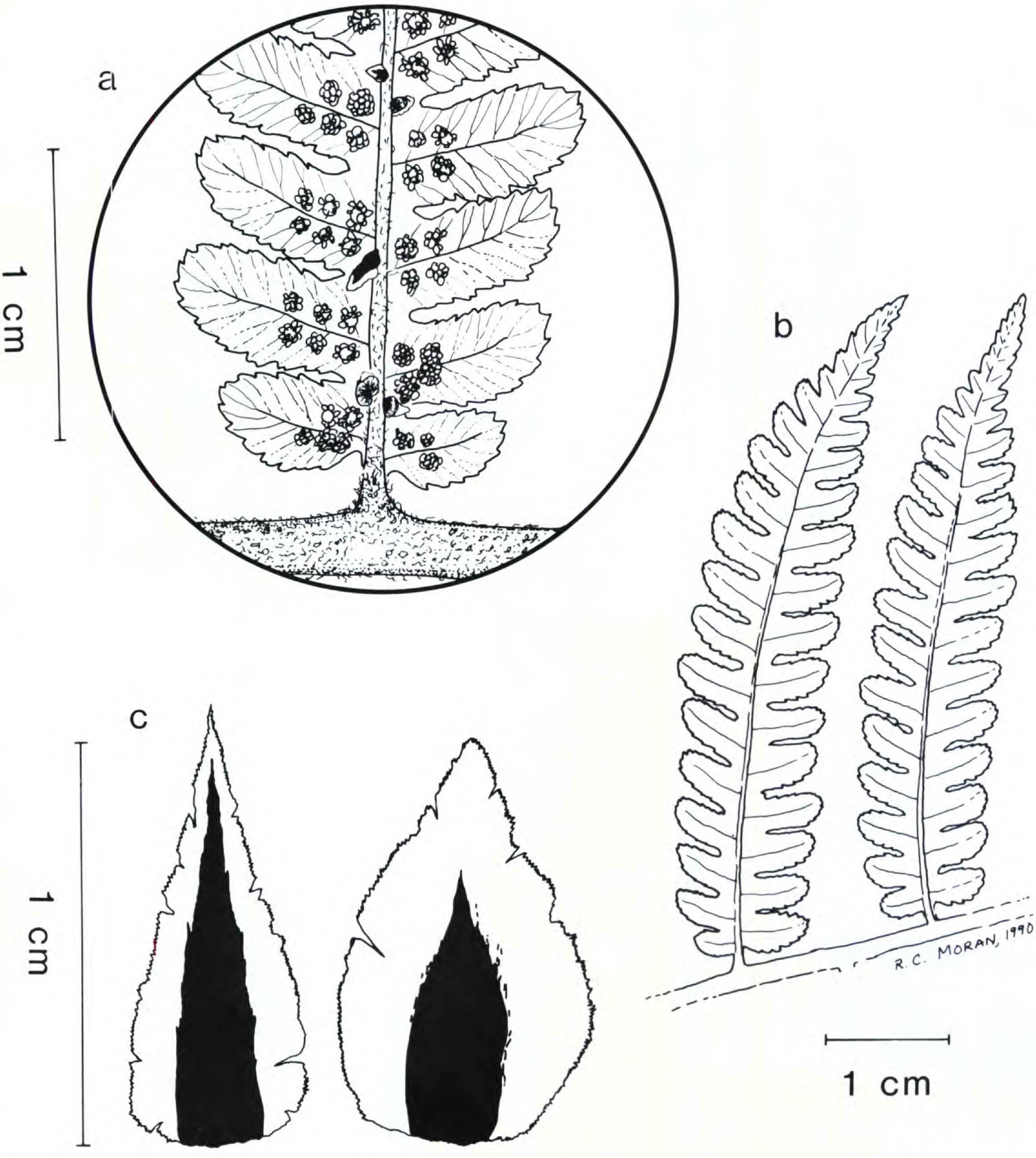


Figure 1. *Cyathea albomarginata.* —a. Pinnule base. —b. Medial pinnules from medial pinna. —c. Petiole scales showing characteristic wide white borders. a–c, *Grayum 7469*, MO.

the sporangia, few, dark red, inconspicuous; indusium absent.

Paratypes. COSTA RICA. HEREDIA: forest between Río Peje and upper Río Guácimo, Atlantic slope of Volcán Barva, 950–1,150, *Grayum et al. 7800* (CR, MO). PANAMA. DARIÉN: Cerro de Garagará, Sambú basin, 500–974 m, *Pittier 5641* (US).

Cyathea nodulifera is endemic to the mountains of Costa Rica and Panama, where it grows in wet forests from 500 to 1,150 m. It resembles *C. kalbreyeri* (Baker) Domin in having long-stalked, deeply lobed pinnules (Fig. 2c) and nonindusiate sori; it differs by having atropurpureous axes, short reddish paraphyses, more abundant costal scales, and nodules at the bases of the pinnae and pinnules. The nodules are 1–2 mm high, light brown (rather than atropurpureous like the axes), and often two or more occur at a given juncture (Fig. 2d). Many species

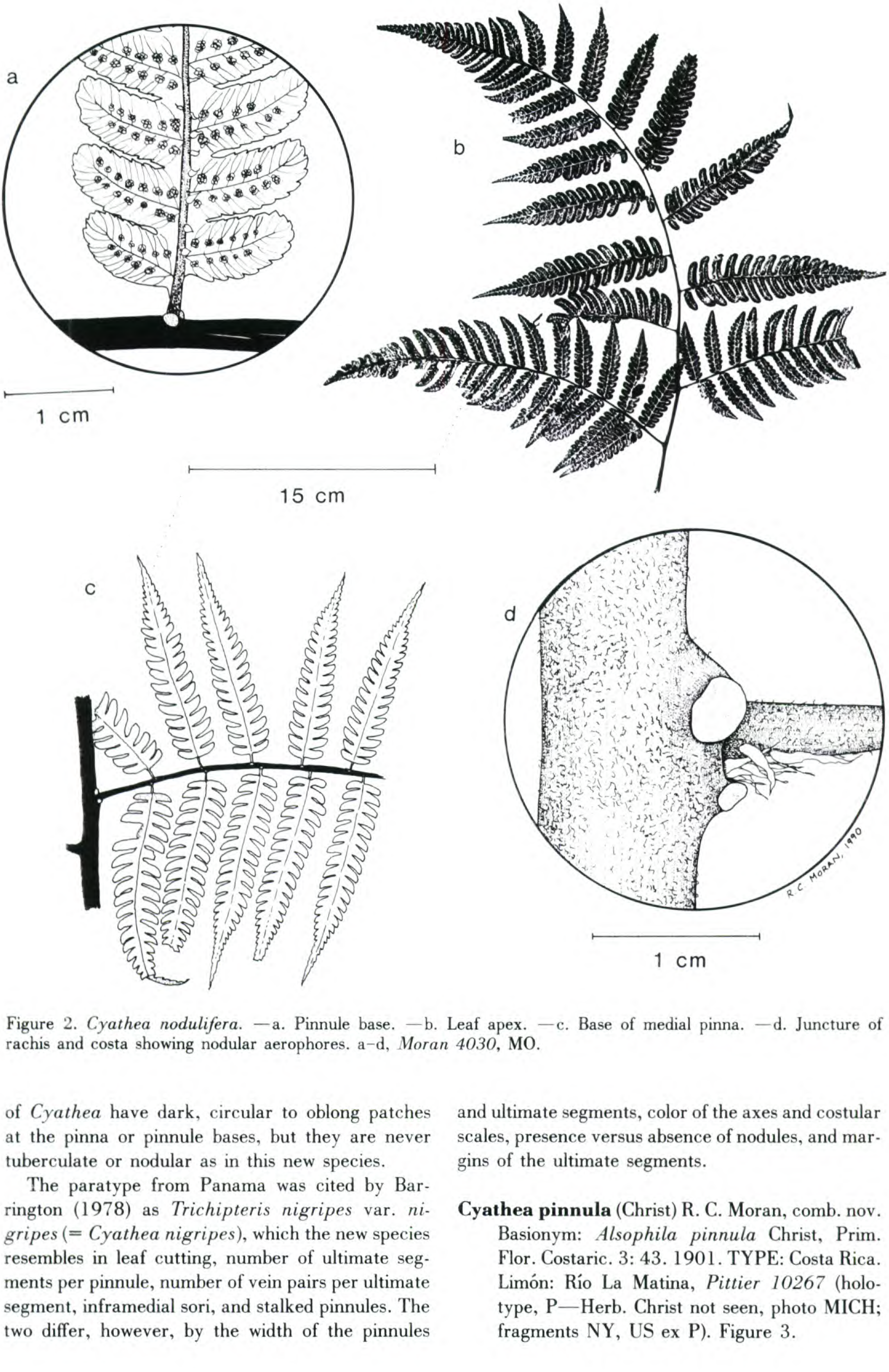


Figure 2. *Cyathea nodulifera*. —a. Pinnule base. —b. Leaf apex. —c. Base of medial pinna. —d. Juncture of rachis and costa showing nodular aerophores. a–d, *Moran 4030*, MO.

of *Cyathea* have dark, circular to oblong patches at the pinna or pinnule bases, but they are never tuberculate or nodular as in this new species.

The paratype from Panama was cited by Barrington (1978) as *Trichipteris nigripes* var. *nigripes* (= *Cyathea nigripes*), which the new species resembles in leaf cutting, number of ultimate segments per pinnule, number of vein pairs per ultimate segment, inframedial sori, and stalked pinnules. The two differ, however, by the width of the pinnules and ultimate segments, color of the axes and costular scales, presence versus absence of nodules, and margins of the ultimate segments.

Cyathea pinnula (Christ) R. C. Moran, comb. nov. Basionym: *Alsophila pinnula* Christ, Prim. Flor. Costaric. 3: 43. 1901. TYPE: Costa Rica. Limón: Río La Matina, *Pittier 10267* (holotype, P—Herb. Christ not seen, photo MICH; fragments NY, US ex P). Figure 3.

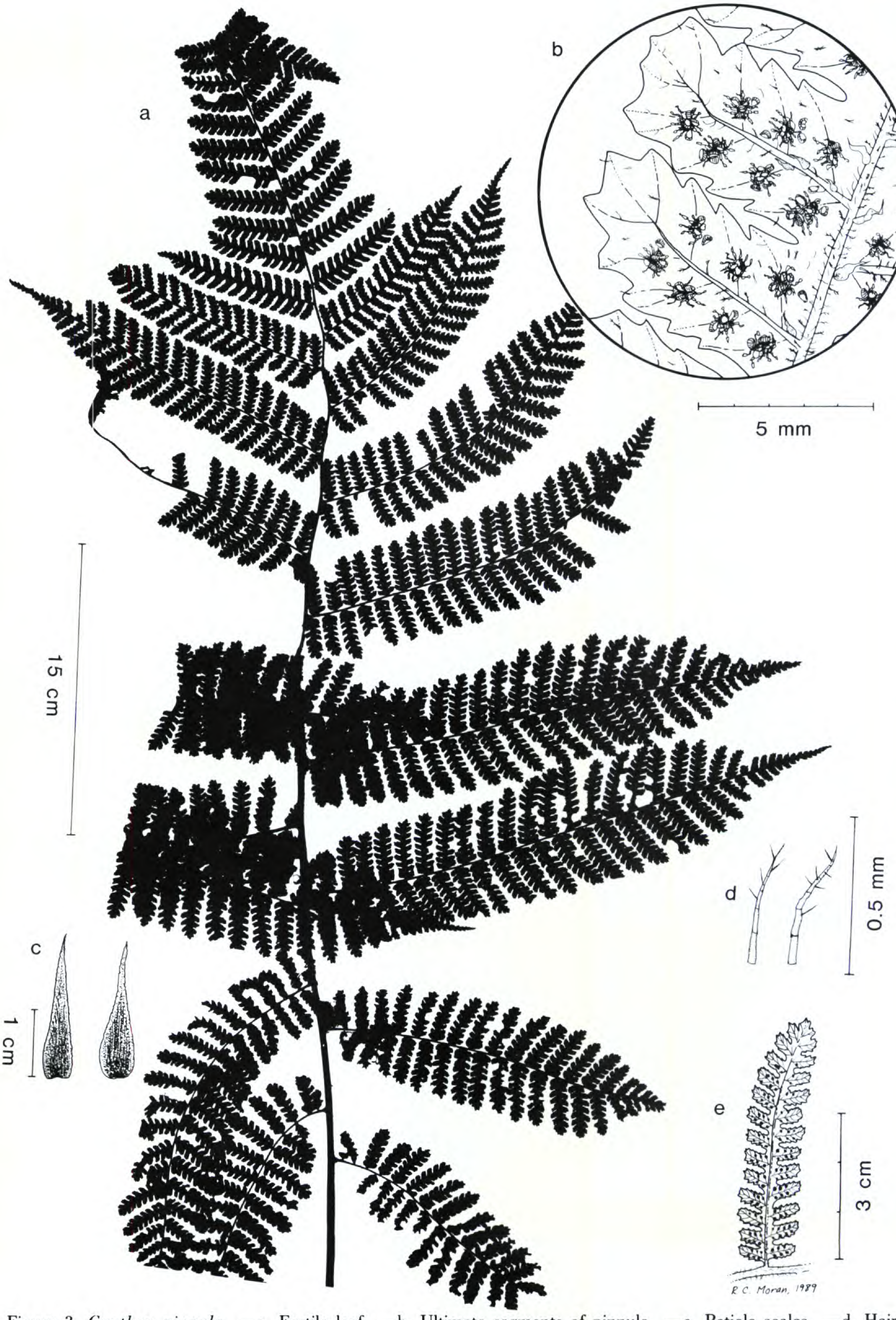


Figure 3. *Cyathea pinnula.* —a. Fertile leaf. —b. Ultimate segments of pinnule. —c. Petiole scales. —d. Hairs from abaxial surface of costa infected with black, acicular fungus. —e. Fertile pinnule. a, *Moran 4133*, MO. b–e, *Liesner & Judziewicz 14701*, MO.

Trunk 0.4–2 m tall, 4–7 cm wide; petiole light brown, spiny or not spiny, the spines 2–5 mm long; petiole scales 10–20 × 3–5 mm, lanceolate, shiny, brown with narrow brownish white borders; petiole scurf consisting of minute light brown trichomidia and squamellae, deciduous and often apparently absent; lamina 2-pinnate-pinnatifid, elliptic, sparsely pubescent between the veins; pinnae 8–14 pairs, narrowly alate between the distal pinnules, stalked, the stalk 4–15 mm long; pinnules 3–7.5 × 1–1.5 cm, sessile or nearly so; ultimate segments 2–3 mm wide, 9–16 pairs per pinnule, obtuse, serrate; rachis glabrous; costae pubescent with trichomes similar to those on the costules, lacking scales; costules pubescent and scaly, the trichomes 0.3–0.4 mm long, subulate, hyaline, erect to spreading, almost always infected by a black acicular fungus (Fig. 3b, d), the scales shiny, golden, ovate with acuminate apices to lanceolate, flat to (especially on distal portions of the lamina) bullate; veins simple, unbranched, pubescent with hairs like those on the axes; laminar tissue between the veins sparsely pubescent with hairs like those of the axes; sori ca. medial; paraphyses conspicuous, equaling or slightly longer than the sporangia, hyaline, jointed; indusia absent.

Additional specimens examined. COSTA RICA. ALAJUELA: Reserva Forestal, San Ramón, 1,350–1,500 m, *Carvajal 334* (MO, UC); 17–20 km NNW of San Ramón by road on way to San Lorenzo, 4–7 km N of Balsa, 750 m, *Liesner & Judziewicz 14701* (MO, UC); Univ. of San Ramón's Biological Field Station, ca. 20 km N of San Ramón, along Río San Lorencito, cloud forest, 10°15′N, 84°30′W, 800–900 m, *Moran 4133* (CR, MO, UC). CARTAGO: SE of Turrialba, ca. 3 km NE of La Suiza, 1,200 m, *Lellinger 1401* (MICH, MO, US). GUANACASTE: Parque Nacional Rincón de la Vieja, SE slopes of Volcán Santa María, above Estación Hacienda Santa María, 900–1,200 m, *Davidse et al. 23401* (MO, UC). HEREDIA: between Río Peje and Río Sardinalito, Atlantic slope of Volcán Barva, 700–750 m, *Grayum & Jermy 6778* (MO, UC). SAN JOSÉ: Parque Nacional Braulio Carrillo, from La Montura to Los Chorritos, 1,200 m, *Gómez et al. 20926* (MO, UC). PANAMA. CHIRIQUÍ: Fortuna Dam area, N fork of the Quebrada de Arena, 1,100 m, *Churchill et al. 4674* (MO, UC); vic. of Fortuna Dam, in valley of Río Chiriquí, along aqueduct trail for water supply for IRHE facilities, 1,100–1,200 m, *Croat 66590* (MO, UC); E of main camp at Fortuna Dam site, 1,400–1,500 m, *Folsom et al. 5450* (MO, UC). VERAGUAS: Cerro Tute, ca. 2 km N of Santa Fé, along ridge trail to summit, 900–1,000 m, *Moran 4032* (MO). COLOMBIA. CHOCÓ: W of Tutunendo, Quibdó–Medellín road, 100 m, *Gentry & Brand M. 36866* (MO); banks of Quebrada Togoromá, dense tidal forest, *Killip & Cuatrecasas 39084* (US).

This species was treated by Barrington (1978) in his *Nomina Incertae Sedis* because he lacked sufficient material to make a certain assignment. Although Christ did not cite a type in his original publication, the above specimen is probably the one he used to describe the species because it is the only specimen in his herbarium labeled in his hand as "*Alsophila pinnula*, sp. nov."

Cyathea pinnula grows in wet forests, cloud forests, and (rarely) tidal forests from (0 to)700 to 1,500 m. It can be distinguished from other species of *Cyathea* in Mesoamerica by the following combination of characteristics: costal scales golden and erose-margined, lamina pubescent between the veins, fertile veins unbranched, sori nonindusiate, and paraphyses conspicuous. A peculiar characteristic is that all specimens examined were infected by a black, acicular fungus. Although the fungus occurs on the laminar tissue and axes, it is most conspicuous when it grows through and out of the hairs (Fig. 3b, d) and scales.

Cyathea pinnula is common in Costa Rica and Panama and has previously been identified (often tentatively with a "?" or "cf.") as *C. wendlandii* (Kuhn) Domin or *C. nigripes* (C. Chr.) Domin. *Cyathea wendlandii* differs from *C. pinnula* by its petiole scales that are smaller (10–15 × 1–1.5 mm) and linear, denser petiole scurf, once-forked fertile veins, entire to crenulate ultimate segments, inframedial sori, minute (ca. 0.1 mm long) appressed hairs on the costules, and tangled mass of paraphyses that are conspicuous after all the sporangia have fallen. In contrast, *C. pinnula* has larger (10–20 × 3–5 mm) lanceolate petiole scales, sparse or absent petiole scurf, simple fertile veins, serrate lobes and segments, medial sori, longer (0.3–0.4 mm) spreading to erect hairs on the costules, and untangled paraphyses that do not appear as a dense mass after the sporangia have fallen (Fig. 3b, e).

Cyathea nigripes differs from *C. pinnula* by its forked fertile veins, entire to crenulate lobes or segments, absence of hairs on the costules, presence of numerous minute squamellae on the costules, brownish costular scales, few short paraphyses, and inframedial sori (Fig. 9c, d).

Cyathea pinnula resembles *C. pilosissima* (Baker) Domin (in Panama and the Chocó) by having the laminar tissue pubescent between the veins; however, *C. pilosissima* differs by having more dense, even pubescence between the veins, pubescent rachises, white costular scales, and entire or crenulate ultimate segments.

Cyathea mucilagina R. C. Moran, sp. nov. TYPE: Costa Rica. Heredia: between Quebrada Tigre and E fork of Río Sardinal, ca. 9 km SW of Las Horquetas, 10°17′N, 84°02′W, 600 m, *Grayum et al. 5042* (holotype, MO; isotypes, CR not seen, US, UC). Figure 4.

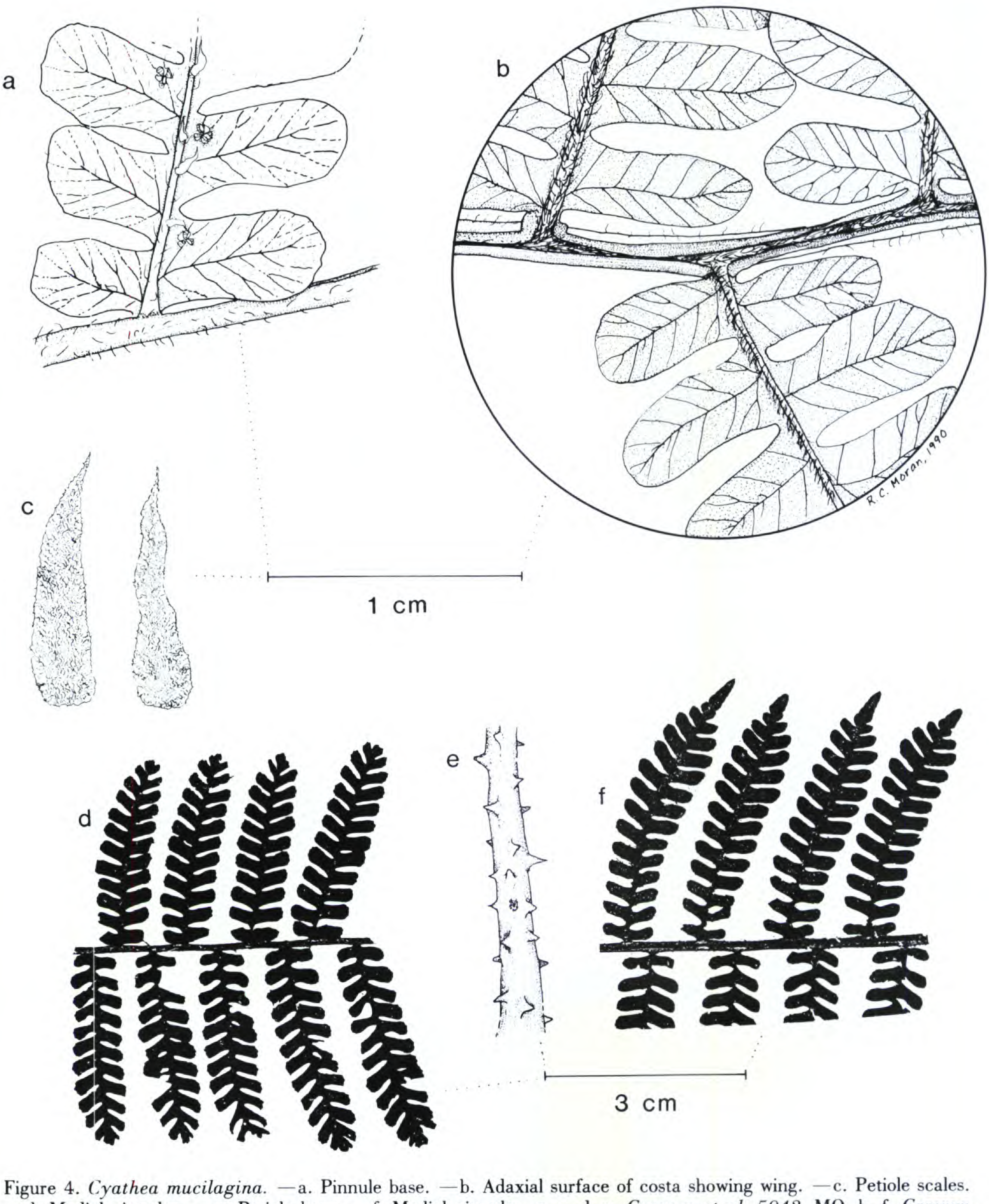


Figure 4. *Cyathea mucilagina.* —a. Pinnule base. —b. Adaxial surface of costa showing wing. —c. Petiole scales. —d. Medial pinnules. —e. Petiole base. —f. Medial pinnules. a, c, d, e, *Grayum et al. 5042*, MO. b, f, *Grayum & Chazdon 6832*, MO.

Folia juvenilia mucilagina; petiolus pallide brunneus, spinosus, puberulus, squamis 15–20 × 4–5 mm, penitus albide brunneis vel parte centrali pallide brunnea, lanceolatis vel elongate oblongis, flaccidis; pinnulae 3.5–5.5 × 1–1.5 cm, sessiles, lobis 2–3 mm latis, obtusis; rhachis costaeque pallide brunneae, spinis destitutae, adaxaliter alatae, alis viridibus, erectis; lamina inter venas pubescens; venae simplices vel semel furcatae; sori ex inframediano ad supramediani, paraphysibus conspicuis; indusia nulla.

Trunk 0.3–2 m tall; petiole tan or light brown, puberulent, spiny, the spines usually 2–3 mm long; petiole scales 15–20 × 4–5 mm, flaccid, matted, whitish brown or light brown medially, lanceolate to long-oblong; petiole scurf present, whitish; lamina 2-pinnate-pinnatifid, ovate to elliptic, gradually tapered to the apex; pinnae 3.5–5.5 × 1–1.5 cm,

sessile; ultimate segments 2–3 mm wide, 10–12 per pinnule, obtuse, entire or denticulate at the apex; rachis and costae tan to light brown, not spiny, with an erect, membranaceous, green wing adaxially, pubescent abaxially, the hairs 0.4–2 mm long, 3–6-celled, spreading, hyaline to whitish, subulate, scales rare or absent; costules pubescent with hairs like those on the costa, scaly, the scales whitish, lanceolate to oblong, flat or bullate at the base, entire; fertile veins simple or 1-forked, 4 or 5 per lobe, pubescent with hairs like those on the costules; laminar tissue between the veins pubescent, the hairs ca. 0.2 mm long, erect to spreading; sori inframedial to supramedial, nonindusiate, without delicate, irregular scales; paraphyses longer than the sporangia, conspicuous, tawny.

Paratypes. COSTA RICA. HEREDIA: forest between the Río Peje and Río Sardinalito, Atlantic slope of Volcán Barva, 10°17′N, 84°4.5′W, 800–1,000 m, *Grayum & Chazdon 6832* (MO, UC). PERU. HUÁNUCO: hills E of Tingo María, *Croat 21153* (MO, UC).

Cyathea mucilagina grows in wet forests from 600 to 1,000 m. It resembles *Cyathea pilosissima* (Baker) Domin by its laminar tissue pubescent between the veins and whitish costular scales; however, *C. pilosissima* (in Panama and the Chocó) has shiny, rigid, dark brown petiole scales with narrow white or light brown borders, nonalate rachises and costae, pinnules 5–9 cm long, and nonmucilaginous croziers. In contrast, *C. mucilagina* has dull, matted, brownish white petiole scales, adaxially alate rachises and costae (Fig. 4), pinnules 3.5–5.5 cm long, and mucilaginous croziers.

Cyathea werffii R. C. Moran, sp. nov. TYPE: Ecuador. Morona–Santiago: along new road Mendez–Morona, km 55–62, bosque húmedo, 800 m, *van der Werff & Gudiño 11386* (holotype, MO; isotypes, AAU, QCNE, UC). Figure 5.

Petiolus obscure flavidobrunneus, spinis destitutus, squamis 3–7 × 1–2 mm, lanceolatis, atrobrunnea parte centrali marginibus albis et interdum atrodenticulatis; lamina 35–50 cm longa, 1-pinnato-pinnatifida vel 2-pinnata, ex angusto lanceolato anguste elliptica; pinnulae ca. 2.3 × 1 cm, obtusae; lobi pinnularum 4–6 mm lati; rhachis pubescens trichomatibus 0.2–0.4 mm longis; squamae costularum 0.5–1 mm longae, brunneae, bullatae; sori mediani, paraphysibus inconspicuis; indusia nulla.

Trunk height unknown, width ca. 2 cm; petiole dull yellow-brown, not spiny, scurf absent; petiole scales 3–7 × 1–2 mm, lanceolate, bicolorous, dark brown medially with white borders (the proportions of brown and white varying considerably), the margins erose with occasional dark brown cells; lamina 35–50 cm long, 1-pinnate-pinnatifid to 2-pinnate, narrowly lanceolate to narrowly elliptic, tapering to the apex; pinnae 15–20 pairs, alternate; pinnules (of 2-pinnate leaves) to 2.3 × 1 cm, obtuse, crenate or shallowly lobed; lobes or ultimate segments (of 1-pinnate-pinnatifid leaves) 4–6 mm wide, obtuse to slightly truncate, ca. 12 pairs per pinna, entire; rachis light yellowish brown, lacking scales or nearly so, pubescent, the hairs 0.2–0.4 mm long, subulate, light brown, erect to spreading; costae sparsely pubescent with hairs like those on the rachis, scaly, the scales 0.5–1 mm long, brown, bullate with abruptly acuminate and often whitish apices; veins simple or forked, glabrous on both surfaces; laminar tissue between the veins glabrous on both surfaces; sori medial; paraphyses inconspicuous, shorter than the sporangia, brown; indusia absent.

Paratype. PERU. AMAZONAS: Puerto Nazareth, 540 m, *Ellenberg 3489* (UC).

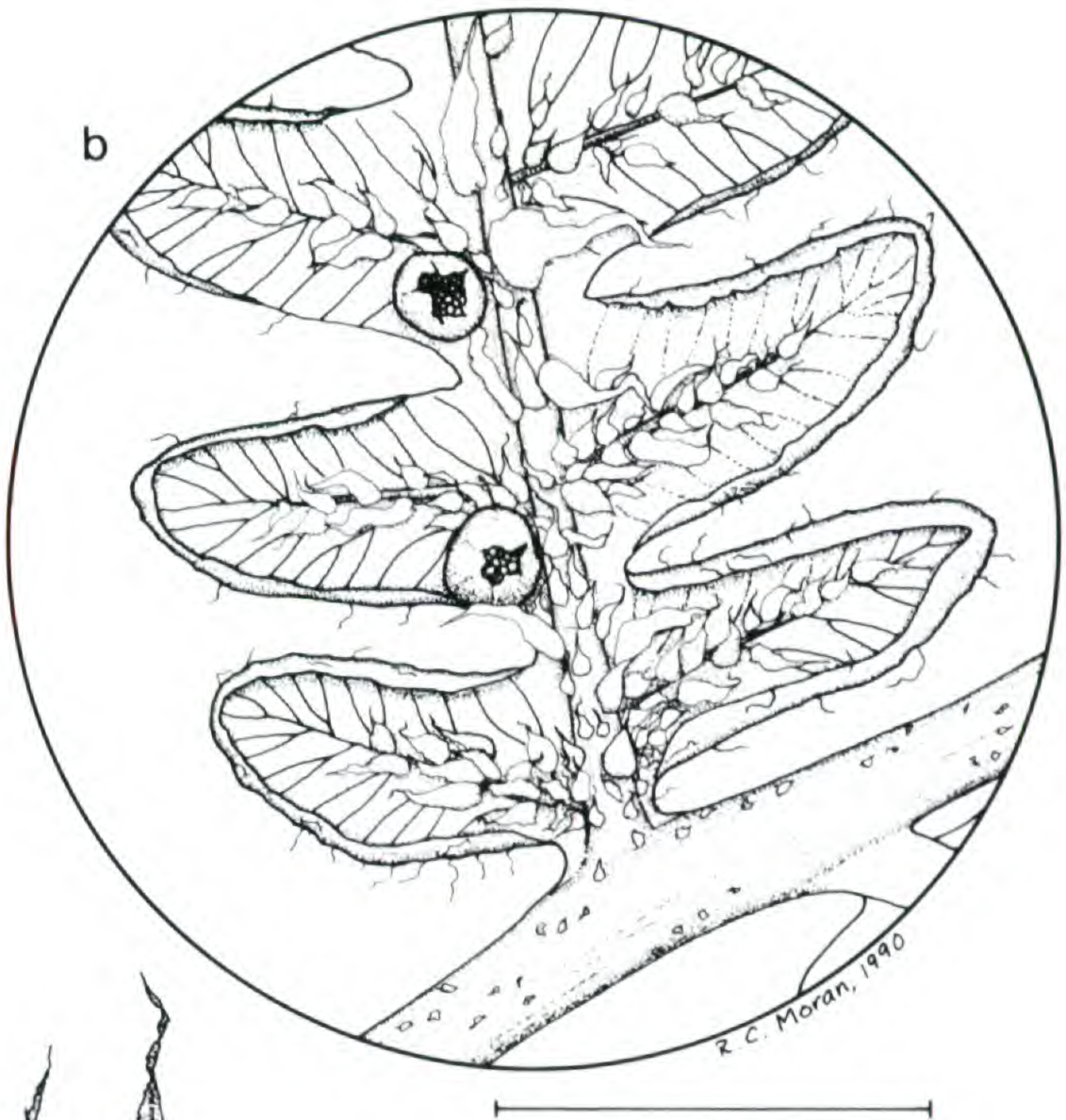
Cyathea werffii grows in wet forests in Ecuador and Peru from 540 to 800 m. This species resembles *Cyathea phalaenolepis* (C. Chr.) Domin in leaf cutting and outline. *Cyathea phalaenolepis* differs, however, by its pilose petiole and rachis (the hairs 2–3 mm long), larger petiole scales (9–15 × 4–6 mm), and restricted occurrence in the Chocó region from 0 to 300 m. This new species is named for Henk van der Werff, Missouri Botanical Garden, who has made hundreds of superb fern collections and has given me much help and encouragement in pteridology.

Cyathea brevistipes R. C. Moran, sp. nov. TYPE: Ecuador. Loja: Parque Nacional *Podocarpus*, along road from Yanaga to radio towers on Cerro Toledo, mostly collected in shrubby páramo, 2,900–3,200 m, *van der Werff & Palacios 9185* (holotype, MO; isotype, UC). Figure 6.

Petiolus 2–11 cm longus, spinis carens, trichomidiis adpressis, ex albido pallide brunneis, squamis 15–30 × 2–3 mm, ex lanceolato linearibus; lamina 40–100 cm longa, elliptica; pinnulae 2.5–6.5 × 0.6–1.8 cm, fere sessiles, lobulis 2–6 mm latis, ex integro crenulatis; squamae costularum integrae, aureobrunneae, ex lanceolato ovatae, complanatae vel bullatae; venae semel furcatae, adaxialiter pubescentes, abaxaliter glabrae; sori inframediani, paraphysibus inconspicuis; indusia globosa.

Trunk 1.5–3 m tall, ca. 3 cm wide; petiole 2–11 cm long, brown to yellowish brown, not spiny, scurf consisting of whitish to light brown, appressed trichomidia; petiole scales 15–30 × 2–3 mm, lanceolate to linear, shiny dark brown medially (with occasional blackish areas) with lighter brown mar-

Figure 5. *Cyathea werffii.* —a. 2-pinnate leaf. —b. 1-pinnate-pinnatifid leaf. —c. Petiole scales. —d. Pinna base with mostly bullate scales. a–d, *van der Werff & Gudiño 11386*, MO.



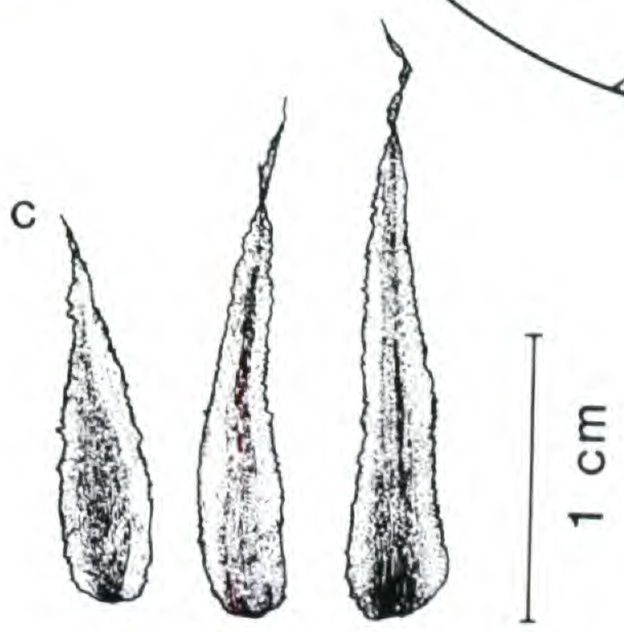


Figure 6. *Cyathea brevistipes.* —a. Fertile leaf. —b. Pinnule base. —c. Petiole scales. a–c, *van der Werff & Palacios 9185*, MO.

gins (these easily abraded or yellowish brown and nearly concolorous); lamina 40–100 cm long, elliptic with the basal pinnae strongly reduced and remote from the next distal pair, the apex gradually tapered; pinnae (exclusive of the distal pinnatifid ones) 11–14 pairs, alternate; pinnules 2.5–6.5 × 0.6–1.8 cm, sessile or nearly so; ultimate segments 2–6 mm wide, entire to crenulate, 10–12 pairs per pinnule, obtuse to acute; rachis, costae, costules, and midribs of the ultimate segments scaly and lacking hairs or puberulent, the scales golden brown, entire, ovate to lanceolate and becoming (on the distal portions of the leaf) orbicular-bullate with abruptly acuminate apices; veins 1(–2)-forked, 5–7 per ultimate segment, dark, glabrous abaxially, pubescent adaxially; laminar tissue between the veins glabrous abaxially, pubescent adaxially, the hairs 0.2–0.4 mm long, appressed, jointed, tortuous, whitish; sori subcostular, borne at the vein fork, indusiate, the indusium sphaeropteroid, with a darkened, indistinct apical umbo; paraphyses inconspicuous, shorter than the sporangia, dark reddish brown.

Paratypes. ECUADOR. LOJA: Cordillera del Loro, 50 km N of Loja, just before descending towards Saraguro, along road to radar station, 3,000–3,200 m, *van der Werff & Palacios 9429* (MO, QCNE, UC); Parque Nacional *Podocarpus*, along road from Yangana to radio towers on Cerro Toledo, 2,900–3,200 m, *van der Werff & Palacios 9187* (MO, QCNE, UC). BOLIVIA. LA PAZ: Dtto. Nor Yungas, 1.4 km E de Cotopata, por el camino entre Unduavi y Chuspipata, bosque nuboso, 3,200 m, *Solomon 18682* (MO, UC); Nor Yungas, La Paz–Yolosa road, ca. 1 km past Cotopata, 3,200 m, *Fay & Fay 2952* (MO).

Cyathea brevistipes grows in shrubby windswept páramos and cloud forests from 2,900 to 3,200 m. It can be distinguished from other Andean species of *Cyathea* by the combination of short (2–11 cm long) petioles, brown, nearly concolorous petiole scales, small (40–100 cm long), elliptical laminae, pubescence of the adaxial surface, subcostular sori, and globose indusia. The basal pinnae are often remote from the suprabasal ones, leaving a gap along the petiole. They occupy a position like the aphlebioid pinnae in *Alsophila*.

I am not sure which species of *Cyathea* is most closely related to *C. brevistipes*, but Rolla Tryon (then at GH, now at USF) annotated the holotype as "C. sp. nov., *straminea* aff." *Cyathea brevistipes*

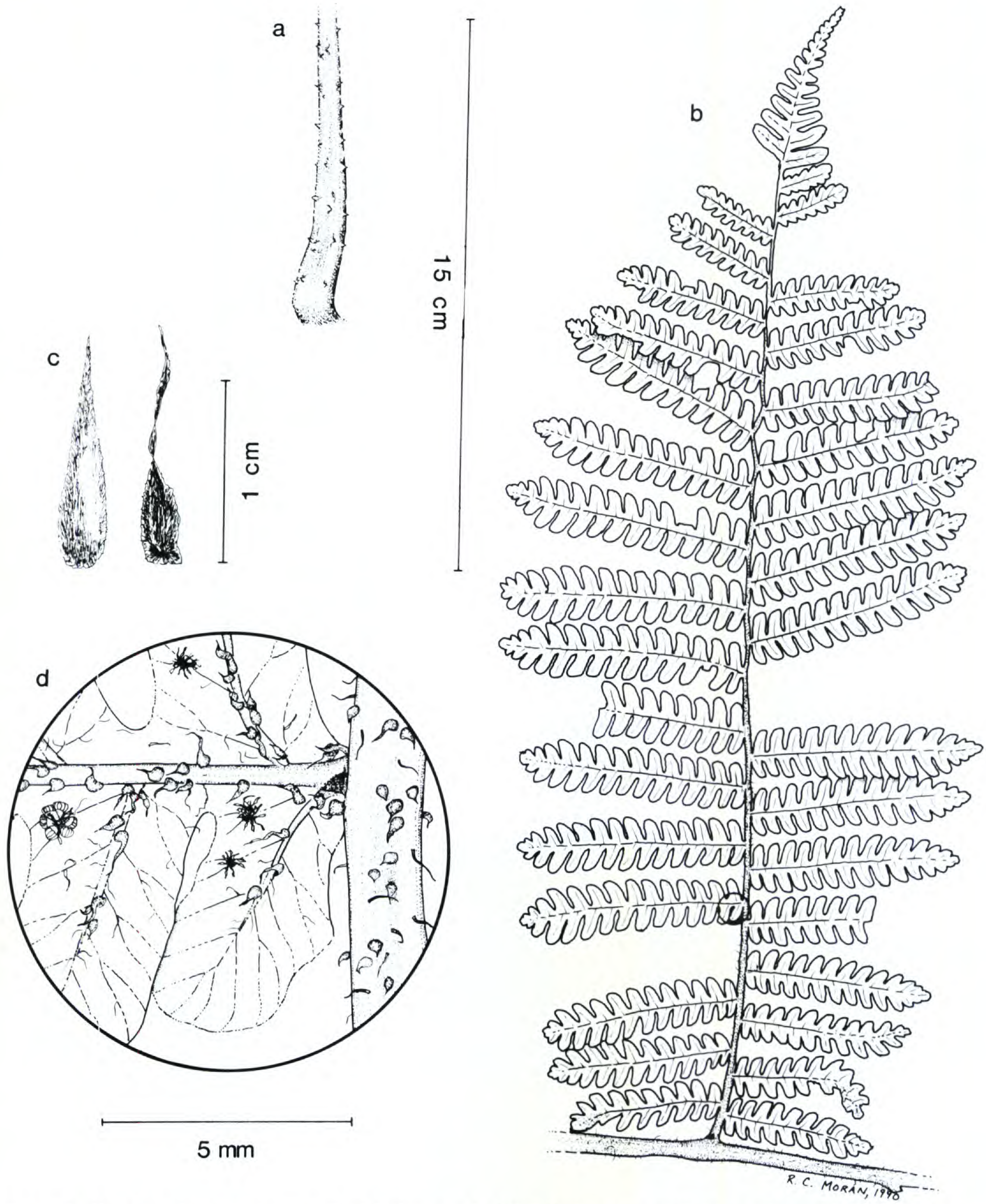


Figure 7. *Cyathea darienensis.* —a. Petiole base. —b. Medial pinna. —c. Petiole scales. —d. Pinnule base, enlargement of circular area shown in b. a, c, *Gentry & Clewell 6957*, MO. b, d. *Hartman 12350*, MO.

differs from *C. straminea* Karsten by its nonspiny petioles, dark brown scales, narrower (0.6–1 cm wide) pinnules, lack of dark peripheral or apical processes on the scales of the axes, entire to crenulate ultimate segments, and inframedial sori. In contrast, *C. straminea* has (according to Tryon, 1986) muricate to aculeate petioles, whitish to pale brown petiole scales, wider (1–2 cm) pinnules, presence of dark peripheral or apical processes on the scales of the axes, slightly to deeply crenate ultimate segments, and nearly medial sori.

Cyathea darienensis R. C. Moran, sp. nov. TYPE: Panama. Darién: summit of Cerro Pirre, 1,000–

1,400 m, 29 Dec. 1972, *Gentry & Clewell 6957* (holotype, MO). Figure 7.

Petiolus atrobrunneus, muricatus, squamis 10–12 × 2–3 mm, concoloribus, lanceolatis, brunneis vel flavide brunneis; pinnulae 5–7 × 1.1–1.7 cm, sessiles, lobulis 3–4.5 mm latis, integris vel crenulatis; costulae squamatae et pubescentes, squamis aureobrunneis, ex ovato lanceolatis vel orbicularibus et bullatis apicibus abrupte acuminatis, trichomatibus erectis subulatis; venae semel furcatae vel raro simplices; sori ex mediano supramediani, paraphysibus inconspicuis; indusia nulla.

Trunk 2–3 m tall, 2–3 cm wide; petiole dark brown, sparsely muricate, the spines less than 1 mm long, scurf present, light brown, easily abraded; petiole scales 10–12 × 2–3 mm, brown to yellow-brown, concolorous or nearly so, entire to denticulate; lamina 0.6–1 m long, 2-pinnate-pinnatifid, ovate, gradually tapered to the apex (always?); pinnae 7–10 pairs (exclusive of apical pinnatifid pinnae), alternate; pinnules 5–7 × 1.1–1.7 cm, sessile, sides parallel for most of their length, apices obtuse to broadly acute; lobes 3–4.5 mm wide, obtuse, 10–13 pairs per pinnule, entire; rachis and costae brown to purplish brown, pubescent, the hairs 1–1.5 mm long, 5–8-celled, hyaline to light brown, spreading; costules and midribs of the ultimate segments pubescent and scaly, the hairs resembling those of the rachis and costae, the scales golden brown, flat and ovate to lanceolate, grading into bullate-orbicular with abruptly acuminate, uniseriate apices; veins 1-forked or rarely (on the same leaf) simple, 4–7 pairs per lobe, dark, sparsely pubescent, the hairs resembling those on the axes; laminar tissue between the veins glabrous; sori medial to supramedial, borne at the vein fork, nonindusiate, without delicate, irregular scales; paraphyses shorter than the sporangia, brownish.

Paratypes. PANAMA. DARIÉN: Cerro Pirre, ridge top near Rancho Plastico, 1,200 m, *Folsom 4245* (MO), *Duke & Elias 13699* (MO); Cerro Sapo, 1,085 m, *Hammel 1174* (MO); SW ridge leading to Alturas de Nique on the Colombian border, 800–900 m, *Hartman 12350* (MO); Parque Nacional del Darién, Panama/Colombia border, near gold mine at headwaters of N branch of Río Pucuro, slopes of Cerro Tacarcuna, ca. 6 km N of Cerro Mali, *Hammel et al. 16560* (MO); Parque Nacional Darién, camino de la Estación de Pirre hacia Rancho Frio, entre el mirador y El Real y la Estación de Pirre, *Polanco 505* (PMA); Serranía de Pirre, NW slope of mountain range, ca. 10 km SSE of El Real, elfin cloud forest, 1,400 m, *Reveal & Duke 4934* (US). PANAMA/COLOMBIA: top of Serranía del Darién, exactly on the frontier with Panama, NE of Cerro Mali, lower montane wet forest, 1,400–1,500 m, *Gentry et al. 17007* (MO).

Cyathea darienensis grows in rainforests and cloud forests from 800 to 1,500 m and is endemic to the Serranía del Darién along the Panamanian–Colombian border. *Cyathea darienensis* is most closely related to *C. brunnescens*. Although Barrington (1978) did not see specimens of *C. darienensis*, this species would key in his monograph to *C. brunnescens* (as *Trichipteris nigripes* var. *brunnescens*). Lellinger (1989) treated *C. darienensis* under *Cyathea nigripes* var. *brunnescens* (Barrington) Lellinger, thus accounting for his citation of "summit of Cerro Pirre" and the elevational extreme of 1,400 m given in parenthesis. In addition to the two characteristics given in the key at the end of this paper, *C. darienensis* differs from *C. brunnescens* by its lack of a delicate, irregular scales attached to the receptacle, darker brown axes, and more numerous bullate scales along the costules.

Cyathea darienensis might be confused with *C. schiedeana* (C. Presl) Domin because both have bullate scales on the costules. *Cyathea darienensis*, however, has concolorous petiole scales, muricate or slightly spiny petioles, nonmuricate rachises, dark brown axes, and pubescent laminar tissue, veins, and axes. In contrast, *C. schiedeana* has (in Costa Rica and Panama) bicolorous petiole scales with narrow white margins, well-developed spines on the petioles, sparsely muricate rachises, tan or light brown axes, and hairs absent on the axes, veins, and laminar tissue between the veins.

Cyathea darienensis also resembles *C. tortulosa* (described herein) by having the axes pubescent with subulate hairs 1–1.5 mm long and concolorous petiole scales. The two differ, however, in geography, elevational range, and the five morphological characters given in the key at the end of this paper.

Two collections from El Valle (*Cuatrecasas 15037*, US; *Killip 11534*, US) and one from Chocó (*Killip 35132*, US), Colombia, greatly resemble *C. darienensis* in cutting and pubescence and may eventually prove to be conspecific. They differ by having larger laminae, lighter axes, and much fewer bullate scales on the costae and costules.

Cyathea squamulosa (Losch) R. C. Moran, comb. nov. Basionym: *Hemitelia squamulosa* Losch, Mitt. Bot. Staatssml. München 1: 20. 1950. TYPE: Costa Rica. Cartago: Orosi, 1,100 m, 14 Mar. 1932, *Kupper 798* (holotype, M not seen, photo BM not seen).

Stem 1–1.5 m; petiole brown, spiny present, brownish, the scales 15–25 × 0.4–0.8 mm, lanceolate, nearly concolorous, brown to yellowish brown; lamina 2-pinnate-pinnatifid, with an evenly tapered, pinnatifid apex; pinnae stalked up to 8 cm; pinnules 8–12 × 1.5–2 cm, stalked 1–3 mm; ultimate segments ca. 4 mm wide, 12–16 pairs per

pinnule, entire or nearly so, obtuse; rachis puberulent, brown or tan, the hairs ca. 0.1 mm; costae pubescent and scaly, the hairs 0.1–0.3 mm, whitish, terete basally, antrorsely strigose, the scales 0.3–0.4 mm, shiny, brown, bullate with apiculate apices pointing toward the rachis; costules pubescent and scaly, the hairs ca. 0.1 mm, appressed, pale reddish, the scales like those on the costae but mixed with a few larger ovate ones; veins simple or 1-forked, 6–8 per segment, puberulent, the hairs ca. 0.1 mm, appressed, pale reddish; sori medial; paraphyses shorter than the sporangia, inconspicuous; indusium scalelike, partly arched over the sorus.

Additional specimens examined. COSTA RICA. CARTAGO: ca. 10 km S of Tapantí along the new road on the E slope above the Río Grande de Orosi, 1,600 m, *Burger & Burger 7578* (MO); Tapantí Reserve, 1,300–1,800 m, *Gómez 19213* (MO, UC), *Pérez-García 227* (MO), *Smith 2191* (MO, UC); new road from Tapantí, ca. 7 km S of bridge, 1,500 m, *Hauke 413* (UC); SE of Orosi, 1,800–2,300 m, *Lellinger 1517* (MO, UC); Taucito de Orosi, 1,400 m, *Pérez-García 176* (MO). PANAMA. CHIRIQUÍ: along road to Fortuna Dam site N of Gualaca on Río Chiriquí, 17.8 mi. beyond the bridge over Río Esti, 7.7 mi. beyond Los Planes de Hornito, 6.6 mi. beyond jct. of road to tunnel, 1,400 m, *Croat 48775* (MO).

Cyathea squamulosa is known only from the Orosi–Tapantí region in Costa Rica and near Fortuna Dam in Panama. It grows in wet forests at middle elevations (1,300–2,300 m).

In his revision of *Cyathea* in the New World, Tryon (1976) placed *C. squamulosa* in synonymy with *C. multiflora* J. E. Smith based on comparison of the original description of the former with specimens of the latter. Tryon apparently did not see any collections of *C. squamulosa* except for a photograph of the holotype. Although I have not seen the holotype, I feel confident that the name is applied here correctly because the original description clearly states that the species has numerous brown bullate scales and hemitelioid indusia. I have examined several collections of *C. squamulosa* and find that it can be distinguished from *C. multiflora* by its numerous, shiny, brown, bullate scales on the axes, stalked pinnae and pinnules, larger and paler petiole scales, and occurrence at higher elevations (*C. multiflora* occurs from 0 to 1,100 m). Although *C. multiflora* is variable in hair type, *C. squamulosa* has only one type of hair along the costules and veins abaxially. These hairs are minute (ca. 0.1 mm long), pale reddish, and appressed.

Cyathea squamulosa, however, is more closely related to *C. schiedeana* (C. Presl) Domin (formerly placed in *Trichipteris*) than *C. multiflora*. *Cyathea squamulosa* differs from *C. shiedeana* only by its stalked pinnae and pinnules, larger and paler petiole scales, and presence of indusia. Otherwise, the hairs and scales on the abaxial surface of the lamina are the same in the two species, and the cutting of the lamina is also similar. These two species, which are very closely related, provide the best example of the artificiality of maintaining *Trichipteris* distinct from *Cyathea*.

Cyathea tortuosa R. C. Moran, sp. nov. TYPE: Ecuador. Napo: Reserva Biológica Jatun Satcha, ca. 8 km ESE de Misahualli, 1°04′S, 77°36′W, 450 m, *Moran & Rohrbach 5187* (holotype, MO; isotypes, F, QCNE, UC, US). Figure 8.

Petiolus ex pallido atrobrunneus, muricatus vel spinosus, squamis 15–20 × 2.5–4 mm, lanceolatis, concoloribus, brunneis; pinnulae 7–10 × 1.5–2 cm, sessiles, lobulis 3–5 mm latis; costulae pubescentes, trichomatibus duorum modorum, altero pilis subulatis et erectis, altero pilis tortuosis et adpressis; venae semel furcatae; sori ex mediano supramediani, paraphysibus inconspicuis; indusia nulla.

Trunks 1–5 m tall, 4–6 cm wide; petiole light to dark brown, muricate to spiny, the spines up to 2 mm long, scurf present, brown to light brown, easily abraded; petiole scales 15–20 × 2.5–4 mm, lanceolate, concolorous, brown, with or without a 1- or 2-cell-wide border of divergent, irregular cells, the margins ciliate, the cilia hyaline, 1–2-celled, easily abraded; lamina 1–1.5 m long, 2-pinnate-pinnatifid, broadly elliptic, abruptly reduced to a pinnalike apex; pinnae 9–11 pairs (exclusive of the pinnalike apical portion), alternate; pinnules 7–10 × 1.5–2 cm, sessile or (in large pinnae) short-stalked to 1 mm, the sides parallel for ca. ¾ of their length, the apex obtuse to acuminate; ultimate segments 3–5 mm wide, 12–17 pairs per pinnule, entire to crenulate, obtuse; rachis and costae tan to brown, pubescent, the hairs 0.8–1.5 mm long, subulate, hyaline to brownish, 4–7-celled, spreading; costules pubescent with 2 kinds of hairs and sparsely scaly, the first type of hair subulate and resembling those on the rachis and costae, the second type of hair 0.1–0.3 mm long, whitish to hyaline, mostly appressed, tortuous, the scales few, ovate-lanceolate to linear-lanceolate, flat to bullate, golden brown; midribs of the lobes pubescent and sparsely scaly, the hairs 0.1–0.3 mm long, whitish to hyaline, mostly appressed, tortuous, the scales 0.2–0.3 mm long, bullate, golden brown; veins 1-forked, dark, 5–7 pairs per ultimate segment, glabrous; laminar tissue between the veins glabrous; sori medial to supramedial, borne at the vein fork, nonindusiate, often with a delicate, hyaline, irregular scale(s) attached to the receptacle (Fig. 8b), these easily detached

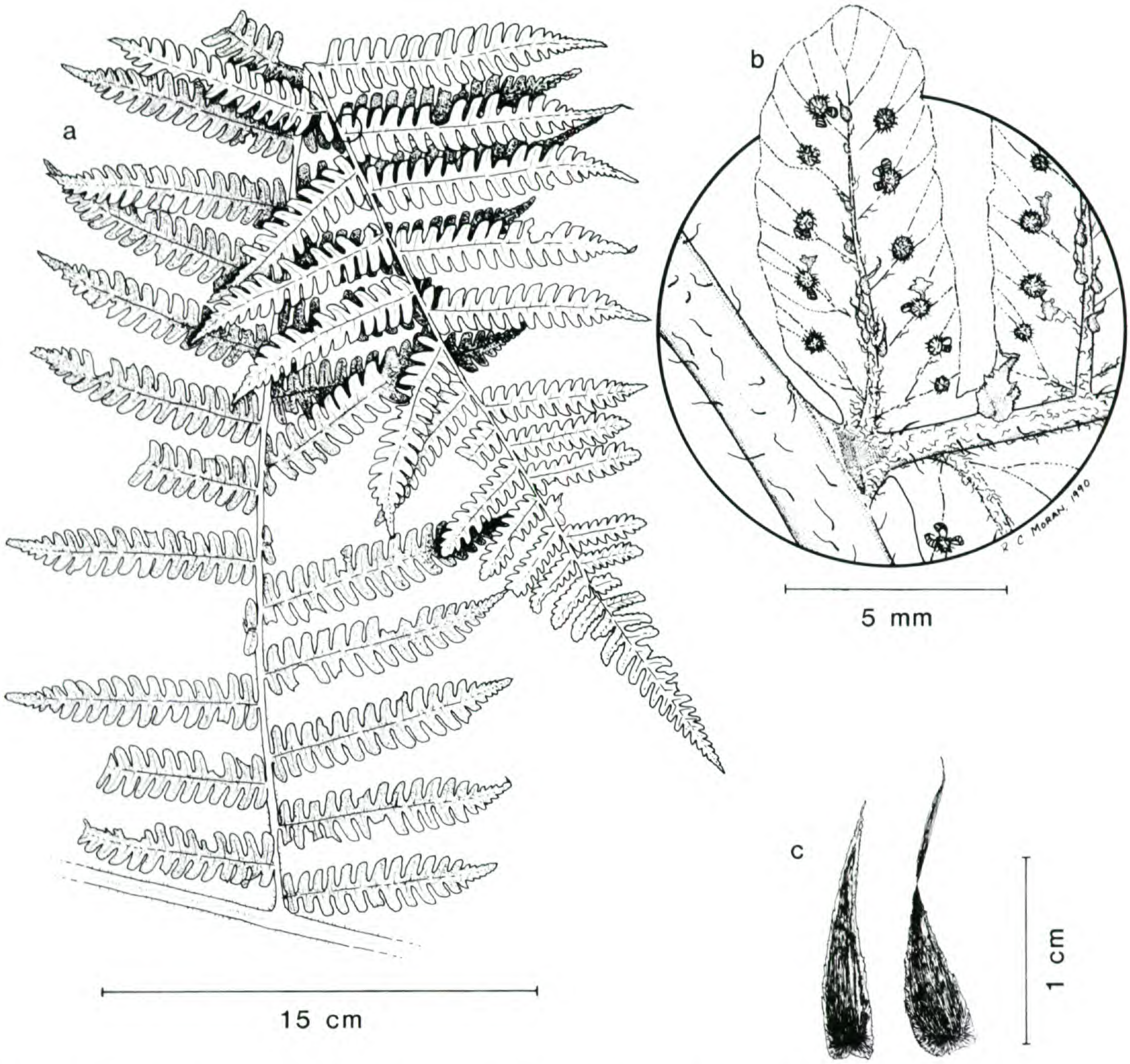


Figure 8. *Cyathea tortuosa.* —a. Medial pinna. —b. Close-up of circle shown in a. Note tortuous hairs and irregular scales attached to some of the receptacles. —c. Petiole scales. a–c, *Miller et al. 2417*, MO.

and often not present; paraphyses shorter than the sporangia, inconspicuous.

Paratypes. COLOMBIA. PUTUMAYO: Mocoa, Quebrada del Río Mulato, 570–600 m, *Cuatrecasas 11299* (US); Uchupayaco, en la planada entre Urcusique y Umbria, en las orillas del Río Uchupayaco, 300 m, *Schultes 3299* (US), *3365* (US). ECUADOR. MORONA–SANTIAGO: along new road Mendez–Morona, 800 m, *van der Werff & Gudiño 11344* (MO, QCNE). NAPO: Cantón Tena, Río Blanco Community, 6 km NNW of Ahuano, 440 m, *Kohn 1209* (QCNE); Cantón El Chaco, valle de Río Quijos, 650 m, *Palacios 5748* (MO, QCNE); Jatun Sacha Biological Station, 8 km E of Misahuali, permanent tree plot no. 1, 450 m, *Gentry et al. 59839* (MO, QCNE), *59898* (MO), *60036* (MO, QCNE, UC), *60231* (MO, QCNE, UC), *Cerón 743* (MO, QCNE), *Miller et al. 2417* (MO, UC); Hacienda Cotapino (Concepción), ca. 550 m, *Harling et al. 7107* (MO, US). PASTAZA: along newly constructed portion of road to Canelos, departing from main Puyo–Macas road at ca. 32 km from Puyo, 22.5 km S of Veracruz, 3.8 km from turn-off, near maintenence camp, ca. 1°37′S, 77°51′W, ca. 850 m, *Croat 58982* (MO, UC). SANTIAGO–ZAMORA: Taisha, ca. 500 m, *Cazalet & Pennington 7665* (UC). PERU. LORETO: above Pongo de Manseriche, streamlet near mouth of Río Santiago, 210 m, *Mexia 6191* (MICH, MO). PASCO: Prov. Oxapampa, near Shiringamazu, up Río Mamuriz, 1–2 km from Río Palcazu, 75°12′W, 10°14′S, 350 m, *Smith & Salick 8370* (MO).

Cyathea tortuosa grows in wet forests of Amazonian Colombia, Ecuador, and Peru, from 200 to 550(to 850) m. The specific epithet *tortuosa* refers to the whitish to hyaline, mostly appressed-tortuous hairs, which occur on the abaxial surface of the costules and midribs of the ultimate segments (Fig.

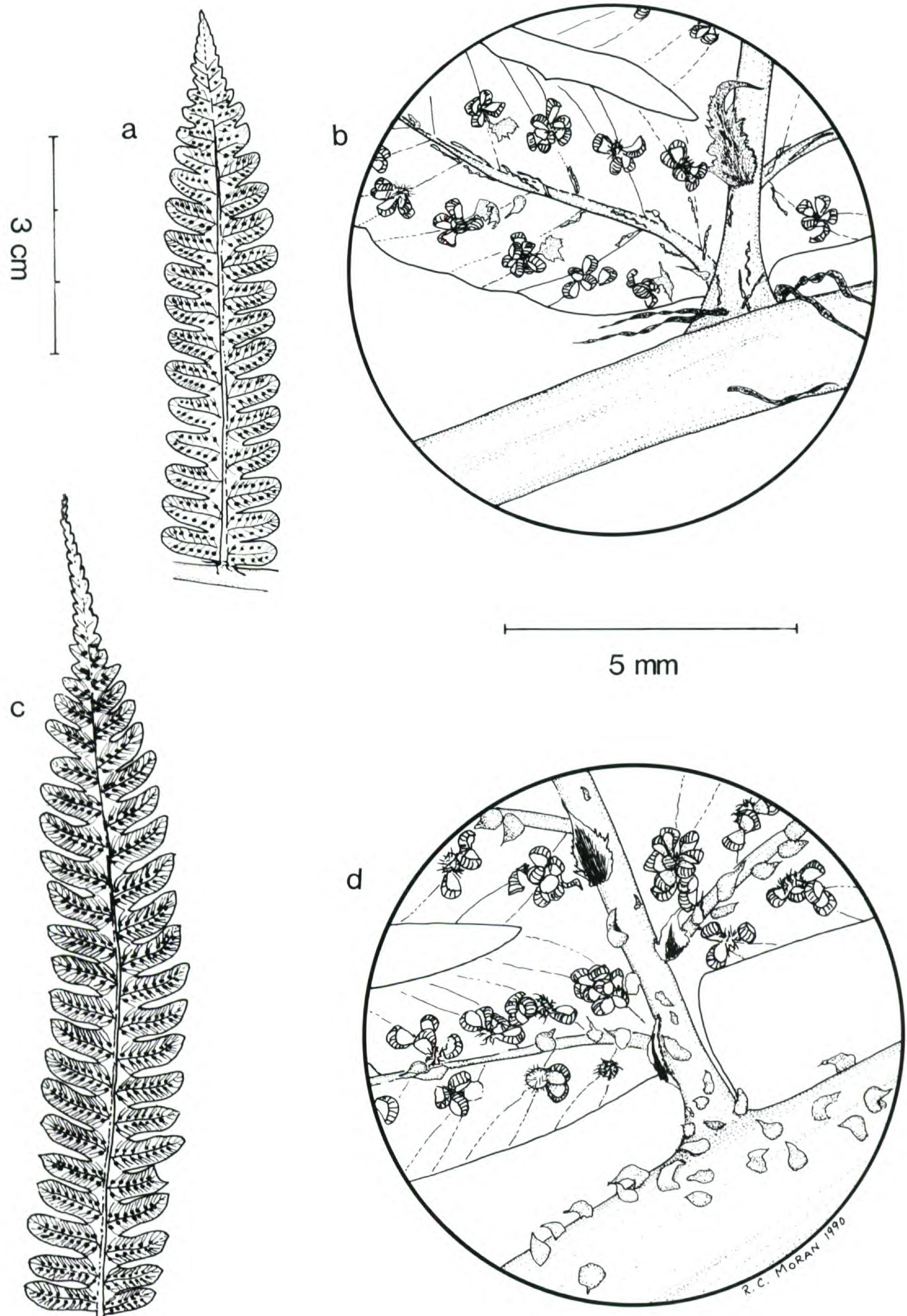
8b). *Cyathea bradei* (Windish) Lellinger has similar hairs but differs most notably by its anastomosing basal veins and presence of a hemitelioid indusium. *Cyathea cyatheoides* (Desv.) Kramer, from the Guianas, Venezuela, and northern Amazonian Brazil, also has similar hairs but differs by possessing a true indusium, longer stalked and wider (2–3 cm) pinnules, setate costular scales, longer and more numerous spines on the petiole, and absence of long, hyaline, subulate hairs on the axes.

Specimens of *C. tortuosa* were cited by Barrington (1978) as *Trichipteris nigripes* (C. Chr.) Barrington var. *brunnescens* Barrington (= *C. brunnescens* (Barrington) R. C. Moran), and by Tryon (1986) as *T. nigripes* (s.l.). *Cyathea tortuosa* differs from *C. brunnescens* by the numerous subulate hairs on the axes, the minute, whitish to hyaline, tortuous hairs on the costules and midribs of the ultimate segments (Fig. 8b), the lack of linear-filiform brown scales, and its occurrence in eastern Amazonia from Colombia to Peru. In contrast, *C. brunnescens* lacks both types of hairs on the axes and has brown, linear-filiform scales on all the axes (these being particularly abundant along the veins and midribs of the lobes; Fig. 9b), and occurs in the Chocó region in western Colombia to northwestern Ecuador. I have not seen any intermediate specimens, i.e., ones that have various combinations of the above characters. This absence of intermediates, plus the fact that each taxon has several correlating characteristics and distinct ranges, leads me to conclude that both should be treated as species. The two species, however, are closer to each other than to any other species of *Cyathea* and should be considered as sister taxa because they agree in all characteristics (other than those given above) including the presence of a delicate hyaline scale associated with the sorus—a character that is apparently unique in the genus (Fig. 8b).

Cyathea brunnescens (Barrington) R. C. Moran, comb. et stat. nov. Basionym: *Trichipteris nigripes* var. *brunnescens* Barrington, Rhodora 78: 4, t. 1, fig. 6. 1976. *Cyathea nigripes* var. *brunnescens* (Barrington) Lellinger, Amer. Fern J. 77: 101. 1988. TYPE: Colombia. Valle: Río Yurumangui, Veneral, 5–50 m, *Cuatrecasas 16155-C* (holotype, US; isotype, GH not seen). Figure 9a, b.

Trunk 1.5–5 m tall, 3–4 cm wide; petiole brown, spiny to tuberculate, the scales 20–30 × 3–5 mm, lanceolate with long-acuminate apices, concolorous, brown, scurf consisting of numerous brown squamellae; lamina 2-pinnate-pinnatifid, the apex abruptly contracted and pinnalike; pinnae stalked, the stalk 1–3 cm; pinnules 6–10 × 1.5–2.3 cm, sessile; ultimate segments 2–4 mm wide, 12–16 pairs per pinnule, entire to crenulate, obtuse; rachis and costae light brown to tan, not spiny, lacking hairs, scaly, the scales flat or becoming bullate on the distal portions of the lamina, brown, varying from large and ovate-lanceolate to minute and linear-filiform; veins 1-forked or rarely simple, 5–7 pairs per ultimate segment, sparsely scaly with filiform scales; laminar tissue between the veins glabrous; sori medial to supramedial, the paraphyses shorter than the sporangia, brown; indusium absent but scales often attached to the receptacle, the scales very delicate, hyaline, irregular, evanescent.

Additional specimens examined. COLOMBIA. CAUCA: Río Naya near El Pastico, 20–100 m, *Gentry & Juncosa 40624* (MO); Córdoba, Dagua Valley, 30–100 m, *Pittier 513* (US), *519* (US). CHOCÓ: La Concepción, 15 km E of Quibdó, *Archer 2090* (US); Mun. de Quibdó, sector puente de Cabí, carretera a Istmina, *Arias et al. 128* (MO); Mun. de Quibdó, Quebrada La Platina, carretera a Medellín, *Arias et al. 157* (MO); along road between Quibdó and Istmina, 6.6 km S of Quibdó, ca. 100 m, *Croat 52146* (MO); Río Negro, between Quibdó and Tutunendo, 80 m, *Cuatrecasas & Llano 24215* (US); Río Serrano, afluente del Río Atrato, *Forero et al. 1389* (MO); Hoya del Río San Juan, Quebrada Taparal, afluente del Río San Juan, alrededores de la comunidad indígena Waunaná de Taparalito, 5–10 m, *Forero et al. 4310* (MO, US); Mun. de Quibdó, Carretera Quibdó–Tutenendo, 15 km de Quibdó, 45 m, *Forero & Jaramillo 2553* (MO); Mun. de Quibdó, corregimiento de Guayabal, Río Hugón, 80 m, *Forero & Jaramillo 2789* (MO); Hoya del Río San Juan, Palestina, cerro al frente de la población, 30–40 m, *Forero & Jaramillo 4492* (MO, US); Mun. de Itsmina, Quebrada Raspadura, entre Raspadura y Quiadó, divorcio de aguas de las Hoyas del Río Atrato y del Río San Juan, *Forero & Jaramillo 5315* (MO, US); carretera Quibdó–Guayabal, 4 km de Quibdó, 40 m, *Forero et al. 1420* (MO); Mun. de Nóvita, vereda Llanadas, ladera N del Cerro Torrá, filo al Oeste del Río Surama, 600–900 m, *Forero et al. 3094* (MO); Carretera Tutunendo–El Carmen, margen del Río Atrato, 600 m, *Forero et al. 5969* (MO, US); area of Baudó, left bank of Río Baudó, 11.5 km upstream from the estuary, near Quebrada Anguerado, *Fuchs & Zanella 22158* (US); Istmina, carretera a Cértegui, 75 m, *García-Barriga 11180* (US); trail to Tubadó, Quibdó–Tutenendo road 14 km NE of Quibdó, 90 m, *Gentry & Renteria A. 24301* (MO); hills near highest point of Bagado–Certegui trail, 130–180 m, *Juncosa 1546* (MO); S of Río Condoto, between Quebrada Guarapo and Mandinga, 120–180 m, *Killip 35132* (US); NW side of Alto del Buey, 950–1,450 m, *Lellinger & de la Sota 212* (US); 1.5–2.5 km W of Istmina along the road to Pie de Pepé, 75–100 m, *Lellinger & de la Sota 428* (US); Mojarras de Tadó, 8.5 km E of Istmina, 150–250 m, *Lellinger & de la Sota 415* (US); low hills behind the beach, 1–1.5 km NW of El Valle N of the lagoon, 25–75 m, *Lellinger & de la Sota 361* (US). EL VALLE: Río Naya, Puerto Merizalde, 5–20 m, *Cuatrecasas 14072* (US); La Trojita, Río Calima, 5–50 m, *Cuatrecasas 16313* (US); Barco, Río Ca-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R.C. MORAN 1990

jambre, 5–80 m, *Cuatrecasas 16989* (US); San Isidro, Río Cajambre, 5–100 m, *Cuatrecasas 17297* (US); Río Cajambre, Silva, 5–80 m, *Cuatrecasas 17478* (US); Bajo Calima Concessión, ca. 16 km NW of Buenaventura, at end of Gasolina road, Juanchaco area, 50 m, *Faber-Langendoen et al. 750* (MO, UC); Córdoba, Dagua Valley, *Killip 11815* (US); Agua Clara, along hwy. from Buenaventura to Cali, ca. 100 m, *Killip & Cuatrecasas 38884* (UC, US); Córdoba, 50–100 m, *Killip & García 33421* (US); foothills of mountains near Buenaventura, ca. 2 hr. by bus from Cali, 100 m, *van der Werff & Brown 9750* (MO, UC). NARIÑO: Quebrada La Toma, on Río Telembi, between Río Pimbi and Río Cuembí, above Barbacoas, 70 m, *Ewan 16860* (UC, US). ECUADOR. PICHINCHA: Tinalandia, property of Hotel Tinalandia, 9.6 km E of Santo Domingo de los Colorados, S of hwy. to Aloag and Quito, above Río Toachi, 700 m, *Croat 55708* (MO, UC).

I consider *C. brunnescens* to be a species (rather than a variety of *C. nigripes* as it has previously been treated) because its distinguishing characteristics do not intergrade with those of other species and there are several that correlate: lack of hyaline subulate hairs on the axes, presence of linear-filiform brownish scales on the axes, medial sori, and sessile pinnules. In addition to these characteristics, *C. brunnescens* differs from *C. nigripes* (Fig. 9) by having 5–7 veins per lobe (vs. 8–10) and occurring at lower elevations.

Cyathea brunnescens is most closely related to *C. schiedeana*, which is another reason for not treating it as a variety of *C. nigripes*. Although *C. brunnescens* and *C. schiedeana* differ in the kinds of scales found on the axes (bullate vs. linear-filiform), they share several characteristics that distinguish them from *C. nigripes* (as well as many other species of *Cyathea*): well-developed petiole spines, sessile pinnules, fewer pairs of ultimate segments (10–14) per pinnule, fewer pairs of veins (4–7) pairs per ultimate segment, and medial sori. The lamina of *C. brunnescens* typically dries dark brownish green.

This species is endemic to the Chocó floristic region from 0 to 300(to 1,000) m. Lellinger's (1989) citation of this species (as *C. nigripes* var. *brunnescens*) from 1,500 m, Cerro Pirre, Panama, actually represents a specimen of *C. darienensis*. (See the discussion under *C. darienensis*.)

New circumscription of *Cyathea nigripes*

Cyathea nigripes has been poorly characterized in the past because not enough attention was paid to features of the hairs and scales on the abaxial surface of the lamina. The removal herein of the three species necessitates a new description of *C. nigripes* in the strict sense. After the following description is a key to *C. nigripes* and the three species previously included in it.

Cyathea nigripes (C. Chr.) Domin, Pteridophyta 263. 1929. *Alsophila nigripes* C. Chr., Index Filic. 45. 1905, nom. nov. for *Alsophila melanopus* Hook., Syn. Fil. ed. 1. 37. 1866, non Hassk. (1855). *Trichipteris nigripes* (C. Chr.) Barrington, Rhodora 78: 4. 1976. Lectotype (designated by Barrington, 1978): Ecuador. Chimborazo: Mt. Chimborazo, *Spruce 5742* (K not seen; isolectotype, P not seen).

Trunk 2–8 m tall, ca. 10 cm wide; petiole brown, muricate to spiny, the spines up to 5 mm long, scales (in the Andes) 20–30 × 2–4 mm, narrowly lanceolate to linear, brown with a very narrow white margin, thin but with a slightly thickened base, or (in Costa Rica and Panama) 10–20 × 2–3 mm, narrowly lanceolate, blackish or dark brown with very narrow white borders, thick (especially at the base); scurf consisting of numerous brown squamellae; lamina 1.5–2 m long, 2-pinnate-pinnatisect, ovate (?), gradually tapered to the apex; pinnae alternate, number of pairs unknown; pinnules 8–15 × 1.5–2 cm, stalked to 3 mm, with the sides parallel for most of their length or gradually tapered, the apex acuminate; ultimate segments 3–4 mm wide, 18–22 pairs per pinnule, entire to crenulate, obtuse to acute; rachis and costae brown, pubescent (in the Andes), the hairs ca. 0.2 mm long, antrorse, or (in Costa Rica) lacking hairs or nearly so and moderately squamellate, the squamellae 0.2–0.5 mm long, brown, ovate and occasionally subbullate, erect (Fig. 9d); costules scaly, the scales ca. 1 mm long, ovate to lanceolate, shiny blackish brown with white erose margins, scurf present, minute, hairlike; midribs of the ultimate segments with minute hairlike scurf; veins 1-forked, 8–10 pairs per ultimate segment, with minute scurf; laminar tissue between the veins glabrous; sori inframedial, borne at the vein fork, nonindusiate, lacking delicate scales; paraphyses shorter than the sporangia, inconspicuous, light brown.

Specimens examined. COSTA RICA. ALAJUELA: 18 km N of San Ramón, 1,200 m, *Armond 147* (F, MO);

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Figure 9. *Cyathea brunnescens* (a, b) and *C. nigripes* (c, d). —a. Pinnule. —b. Basal basiscopic segment of pinnule. Note irregular scales attached to some of the receptacles. —c. Pinnule. —d. Basal segments of pinnule. a, b, *Forero & Jaramillo 4492*, MO. c, d, *Lellinger & White 1229* (MO).

N of San Ramón, ca. 4 km N of Balsa along road to Colonia Palmareña, 1,300 m, *Lellinger 1251* (UC), *1229* (MO). CARTAGO: valley of the Río Grande del Orosi, Tapantí to 7 km S, ca. 20 km SW of Cartago, 1,500 m, *Tryon & Tryon 7024* (F); slopes 4.5 km from bridge at Tapantí, ca. 1,500 m, *White & Lucansky 1968120* (US). SAN JOSÉ: 17 km N of San Isidro del General toward Cerro de la Muerte, 1,160 m, *Gastony & Gastony 754* (F); La Palma and vicinity, ca. 17 km NE of San José, above La Hondura, 1,450 m, *Gastony & Gastony 769* (F); La Ventana, adelante de La Palma, Parque Nacional Braulio Carrillo, 1,200–1,300 m, *Pérez-García 199* (MO). COLOMBIA. CALDAS: Río Santa Rita, Salento, 1,600–1,800 m, *Killip & Hazen 9013* (US). CAUCA: Km 19 on road from Cali to Buenaventura, *Barrington 501* (US). EL VALLE: Hoya del Río Dígua, Quebrada del San Juan, subiendo a Paragüita desde Queremal, 1,570–1,740 m, *Cuatrecasas 23813* (US); Santa Helena, above Topacio, edge of Los Farallones de Cali National Park, 1,940 m, *Gentry & Monsalve 53153* (MO, UC); Mpio. Calima, valle Sevilla–Barragán, 1 km de Sevilla, 1,600 m, *Silverstone 692* (MO, UC). VALLE DEL CAUCA: hoya del Río Calima, El Cairo, entre Darién y Mediacanoa, 1,650–1,750 m, *Cuatrecasas 13930* (US); hoya del Río Cali, Pichindé, Alto de las Brisas, 2,160 m, *Cuatrecasas 18240* (US); native forest of Finca Kyburz, E slope above the Bitaco River, Bitaco Valley 1 km above and E of Bitaco, Pacific slope of the western cordillera, ca. 1,500 m, *Hutchison & Idrobo 3003* (MO, UC, US). ECUADOR. COTOPAXI: Cacaoal, *Bell 918* (UC). PICHINCHA: Corazón, in Aug. 1892, *Sodiro s.n.* (UC); prope Sta. Domingo, 10/884, *Sodiro s.n.* (MO). DEPT. UNKNOWN: San Florentino, *Sodiro s.n.* (UC); near Angaurura, 12/906, *Sodiro s.n.* (MO).

Cyathea nigripes grows in wet forests from Costa Rica to Ecuador from 1,200 to 1,940 m. The Costa Rican and Panamanian specimens differ from the Andean ones by their conspicuously squamellate and nearly hairless rachises and costae, and smaller, darker, thicker petiole scales. Further study may reveal that they represent a distinct species.

Although Tryon & Stolze (1989) treated *Cyathea nigripes* in Peru, I have not seen a bona fide specimen of *C. nigripes* from that country, and the specimens they cited are probably referable to other species. For example, *Mexia 6191* is referable to *C. tortuosa*, and it is likely that the other specimens cited from the departments of Amazonas and Madre de Dios also represent that species. Two other specimens that they cited (*Croat 21153* and *Smith et al. 1179*) are certainly not *C. nigripes*, but I am not sure to what species they belong and perhaps they represent an undescribed species. These specimens differ from *C. nigripes* by lacking hairs on the axes, having brown or whitish bullate scales with filiform apices along the costules, strongly ascending veins, medial sori, and petiole scales without narrow whitish margins.

Key to the species formerly included in *Cyathea nigripes*

1a. Sori inframedial; largest pinnules 10–15 cm long, stalked 1–3 mm; lobes 15–20 per pinnule; veins 8–10 pairs per ultimate segment; (300–) 1,000–1,600 m; Costa Rica to Ecuador .... *C. nigripes*

1b. Sori medial to supramedial; pinnules 5–10 cm long, sessile or rarely short-stalked to 1 mm; lobes 10–17 per pinnule; veins 4–7 pairs per ultimate segment.

2a. Axes lacking hairs; at least some of the scales on the costae and costules linear-filiform; 0–300(–1,000) m; Chocó region of western Colombia and northwestern Ecuador ..... *C. brunnescens*

2b. Axes pubescent with hairs 1–1.5 mm long; none of the scales on the costae and costules linear-filiform.

3a. Costules and midribs of the ultimate segments pubescent with sublate, spreading, 4–7-celled hairs 0.8–1.5 mm long *and* tortuous, whitish to hyaline, mostly appressed hairs; largest pinnules 7–10 cm long; lobes 12–17 pairs per pinnule; veins glabrous or nearly so; sori with delicate, hyaline, irregular scales (these easily detached and often not present on a given sorus); 200–550(–800) m; Amazonian Colombia, Ecuador and Peru ..... *C. tortuosa*

3b. Costules and midribs of the lobes pubescent with subulate hairs as in the above species, but lacking tortuous, white to hyaline, mostly appressed hairs; largest pinnules 5–7 cm long; lobes 10–13 pairs per pinnule; veins sparsely pubescent; sori lacking delicate, hyaline, irregular scales; 800–1,500 m; Panama/Colombia border ..... *C. darienensis*

Acknowledgments. I thank Alan R. Smith for commenting on the manuscript, and Henk van der Werff and Bruno Manara for checking the Latin descriptions. I thank the curators at F, UC, and US for making loans available to me for study.

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A New Combination in *Tabernaemontana* (Apocynaceae)

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In preparation of the *Stemmadenia* and *Tabernaemontana* (Apocynaceae) treatments for the upcoming *Flora of the Venezuelan Guayana*, the following new combination is required.

Tabernaemontana cerea (Woodson) Leeuwenb., comb. nov. Basionym: *Stemmadenia cerea* Woodson, Bull. Torrey Bot. Club 75: 557. 1948. *Anartia cerea* (Woodson) Allorge, Mém. Mus. Natl. Hist. Nat. sér. 2B, 30: 58, pl. 22. 1985. TYPE: Guyana. Georgetown, NW portion of Kanuku Mts., Mt. Iramaikpang, *A. C. Smith 3606* (holotype, MO; isotypes, A, B, G, MG, NY, P, S, U, W).

Tabernaemontana cerea does not have the 5 wings below the anthers inside the corolla tube, the most important character to distinguish *Stemmadenia* from *Tabernaemontana*. *Anartia* is a synonym of *Tabernaemontana* (see Leeuwenberg, J. Ethnopharm. 10: 5. 1984).

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Oligotrichum denudatum (Polytrichaceae), a New Moss Species from Minas Gerais, Brazil

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Among the bryophytes collected in Brazil in 1984 by Daniel M. Vital and William R. Buck is an interesting new species of *Oligotrichum* with elamellate leaves. The collection includes both male plants and female plants with mature sporophytes, making possible a full characterization of the species.

Oligotrichum denudatum Merrill, sp. nov. TYPE: Brazil. Minas Gerais: Mun. São Roque de Minas, mesic forest and riverside at base of waterfall, Parque Nacional da Serra da Canastra, Cachoeira Casca D'Anta, 20°18′S, 46°31′W, elevation 1,000 m, 19 Sep. 1984, *Vital & Buck V-11941* (holotype, NY; isotypes, KSC, MO, SP). Figure 1.

Inter species australes *Oligotrichi* ad *O. riedelianum* accedens sed foliis latioribus absque lamellis differt.

Plants caespitose, stems 3–5 cm tall (male plants taller, to 7 cm). Leaves distant to loosely imbricate, spreading when moist, crispate when dry, lanceolate, 3–5 mm long, 1 mm wide, unbordered, somewhat concave to channeled at the apex, the costa narrow and toothed on the back near the apex; leaves of male plants distant and smaller, concave, 2 mm long, 0.75 mm wide; leaf margins entire below, bluntly serrate in the upper ½; lamellae lacking (or rarely as traces at the apices of the perigonial and perichaetial leaves); median cells of lamina unistratose, rounded-quadrate to somewhat transversely elongate, 17–22 μm across, in ± regular longitudinal rows; median basal cells longitudinally elongate, rectangular, 35–50 μm long, shorter and quadrate at the margins. Dioicous. Perigonial bracts broadly triangular-ovate, forming a large, conspicuous rosette. Perichaetial leaves longer than the vegetative leaves. Setae slender, 2.5 cm long; capsules inclined to horizontal, oblong-cylindric, not angled, 4 mm long, 1–1.5 mm diam., with stomata near the base; exothecium smooth, the cells quadrate to transversely elongate, 35–50 μm across, cells around the stomates scarcely differentiated; peristome teeth 32, single, pale and attenuate. Calyptra smooth.

Additional specimen examined. BRAZIL. MINAS GERAIS: Mun. São Roque de Minas, type locality (see above), 19 Sep. 1984, *Vital & Buck V-11931* (NY, SP).

The specific epithet "denudatum" refers to the absence of lamellae as well as to the lack of hairs on the calyptra. *Oligotrichum denudatum* belongs to the southern hemisphere group of species of *Oligotrichum* (see Smith, 1971), which is characterized by simple (single), attenuate peristome teeth. The related Brazilian species, *Oligotrichum riedelianum* (Mont.) Mitt., has well-formed lamellae on the midrib, and leaves that tend to be narrower and more linear than those of *O. denudatum*. *Oligotrichum denudatum* might be confused with *Atrichopsis compressa* (Hook. f. & Wilson) G. L. Smith (*A. magellanica* Card.), which also lacks lamellae but has a bistratose lamina and leaves densely cuticular-papillose on both surfaces in the upper half (Smith, 1969).

Acknowledgments. I am grateful to William R. Buck, who recognized the distinctiveness of this species and made the specimens available to me for study. This paper is contribution no. 91-567-J from the Kansas Agricultural Experiment Station.

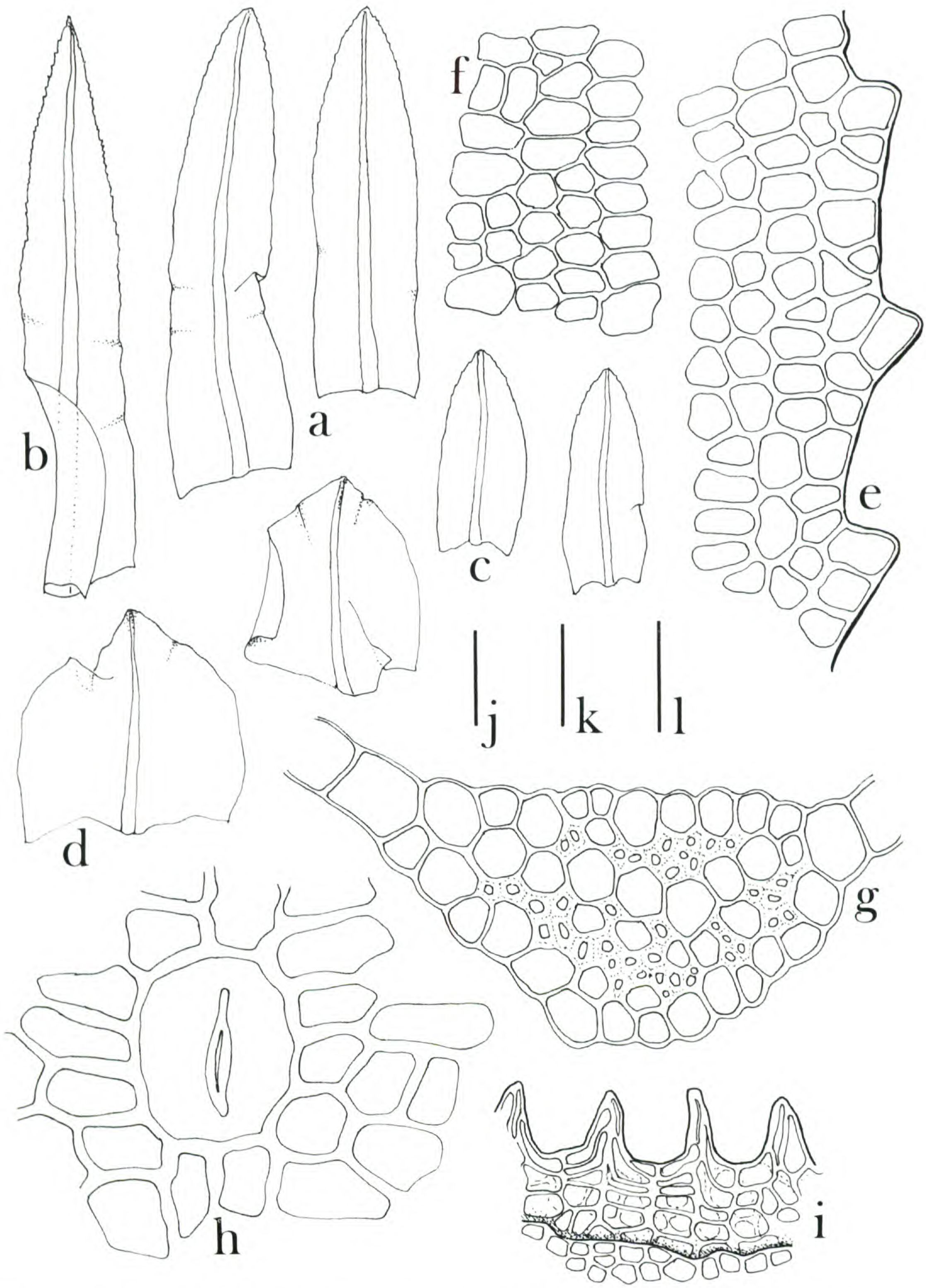

Figure 1. *Oligotrichum denudatum* Merrill. —a. Leaves of female plant. —b. Perichaetial leaf. —c. Leaves of male plant. —d. Perigonial leaves. —e. Cells of upper leaf margin. —f. Median leaf cells. —g. Cross section of costa. —h. Exothecial cells and stoma. —i. Peristome. Scales j = 1 mm (a–d); k = 0.03 mm (e–h); l = 0.1 mm (i). (All drawings from the type.)

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Thamnobryum capense comb. nov. (Neckeraceae, Musci)

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Thamnobryum capense (Broth. & Dix.) Enroth, comb. nov. Basionym: *Thamnium capense* Broth. & Dix. in Dix., Bull. Torrey Bot. Club 43: 71. 1 f. 2. 1916. *Porothamnium capense* (Broth. & Dix.) Sim, Trans. Roy. Soc. South Africa 15: 404. 1926. TYPE: South Africa. "Habitat: in packing from Cape Town, *710*, communicated by G. Webster" (Dixon, 1916) (holotype, BM not seen; isotype, H-Broth, "ex herb. H. N. Dixon"). Illustrations: Dixon (1916: pl. 1, fig. 2); Sim (1926: 404).

De Sloover (1983) noted that *Porothamnium capense* (Broth. & Dix.) Sim may belong to the genus *Thamnobryum* Nieuwl.: "D'après les descriptions et illustrations, cette espèce semble appartenir au genre *Thamnobryum*." However, he did not make a new combination, possibly because he had not seen the type specimen. In connection with preliminary studies on the Neckeraceae for the *Bryologia Africana Project*, I examined the isotype deposited in H-Broth. The habit, leaf areolation, and the abaxially strongly toothed costa clearly indicate the generic position of *Thamnobryum capense* (Broth. & Dix.) Enroth.

Sim (1926) cited a specimen (*Wood 285*, NYS) from Inanda, Natal in eastern South Africa. I have not seen that specimen, but Sim's illustrations clearly represent this species; he had also examined the type material deposited in Dixon's herbarium at BM.

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Novon 1: 110. 1991.

Novelties in *Panicum* Subg. *Dichanthelium* Sect. *Dichanthelium* (Poaceae: Panicoideae: Paniceae)

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Several new taxa of *Panicum* L. sect. *Dichanthelium* A. Hitchc. & Chase are described in this work, prior to the publication of some of these species in the treatment of *Panicum* for *Flora of Paraguay* and a paper in press on *Panicum sabulorum* Lam. and related species (Morrone & Zuloaga, in press).

Panicum surrectum Chase ex Zuloaga & Morrone, sp. nov. TYPE: Brazil. Minas Gerais: Barbacena, long and tangled in moist brushy base of higher slope, *Chase 8664* (holotype, US; isotypes, F, NY). Figure 1.

Laminae lineari-lanceolatae, 5–12 cm longae. Spiculae longe ellipsoidae, 1.8–2.2 mm longae; gluma inferiore 0.9–1.3 mm longa, glumae superioris basim non amplectente; gluma superiore 9-nervia; lemmate inferiore 9-nervio. Flos inferior masculinus vel carens. Anthoecium superior ellipsoideum, 1.6–1.8 mm longum; lemmate minute cristato.

Short-rhizomatous perennials. *Culms* decumbent to geniculate, then erect, 45-120 cm tall, branching at the upper nodes, scandent; internodes compressed to cylindric, 7–13 cm long, glabrous; nodes compressed, glabrous, brownish. *Sheaths* 4–10.5 cm long, shorter than the internodes, glabrous to papillose-pilose toward the base, shiny, one margin ciliate, the other one ciliate toward the base, otherwise glabrous. *Ligules* 0.2 mm long, membranous-ciliate; collar pilose. *Blades* linear-lanceolate, 5–12 cm long, 0.6–1 cm wide, glabrous to short-hispid, attenuate at the base and apex, the margins scabrous, long-ciliate toward the base; midnerve conspicuous. *Inflorescences* terminal, exserted; *panicles* lax, diffuse, 3.5–15 cm long, 3–10 cm wide; *main axis* with or without glands, wavy, glabrous, the pulvini glabrous; first-order branches ascendent, whorled toward the base, then subopposite or alternate, the axis of the branches glabrous, flexuous, with or without glands; pedicels triquetrous, glabrous, with or without glands. *Spikelets* narrowly ellipsoid, 1mm long, 0.8 mm wide, glabrous, greenish, non-stipitate; upper glume and lower lemma subequal, the nerves manifest. *Lower glume* ovate, 0.9–1.3 mm long, ⅖–½(–¾) the length of the spikelet, not embracing the upper glume, (1–)3-nerved, the lateral nerves inconspicuous. *Upper glume* 1.6–2 mm long, not covering the apex of the upper anthecium, 9-nerved. *Lower lemma* glumiform, 1.8–2.1 mm long, 9-nerved. *Lower palea* lanceolate, 1.5–1.8 mm long, 0.4 mm wide, shortly pilose near the apex, otherwise glabrous, hyaline. *Lower flower* male; stamens 3 or absent, anthers 1 mm long. *Upper anthecium* ellipsoid, 1.6–1.8 mm long, 0.7 mm wide, pale, indurate, papillose, the apex of the lemma shortly crestate and pilose. *Upper flower* bisexual; lodicules 2, covering the lower margins of the palea; stamens 3, the anthers 1.2 mm long, purplish; styles 2, free, stigma purplish. *Caryopsis* ovoid, 1.3 mm long, 0.7 mm wide; hilum punctiform; embryo less than ¾ the length of the caryopsis.

Distribution and ecology. Brazil, occasionally present in Paraguay, forest edges, between 600 and 1,800 m.

Paratypes. BRAZIL. DISTRITO FEDERAL: ca. 35 km E of Brasília, *Irwin & Soderstrom 5419* (NY, UB, US). GOÍAS: Luziania, 15 km ao sul da cidade, *Heringer 18124* (IBGE, RB). MATO GROSSO DO SUL: Dourados, *Chase 11023* (IAN). MINAS GERAIS: 19 km NE of the intersection of highways 381 and 459, ca. 12 km SW of São Gonçalo do Sapucai, 870 m, *Davidse & Ramamoorthy 10602* (MO, SI); 19 km SE of Consolheiro Lafaiete along highway 135 to Barbacena, 1,040 m, *Davidse & Ramamoorthy 10704* (MO, SI); Diamantina, Serra de San Antonio, 1,200–1,300 m, *Chase 10387* (US); Itacolumí, East of Ouro Preto, 1,400 m, culms ascending among bamboo and brush, *Chase 9380* (NY, US), *9407* (US); Juiz de Forá, *Krieger SVD 1227* (RB); Poços de Caldas, 1,100–1,500 m, *Chase 10677* (NY, SP, US); lower slopes of Serra da Caraça, ca. 10 km W of Barão de Cocais, ca. 1,400 m, *Irwin et al. 28942* (MO); Serra do Cipó, 1,200 m, *Anderson et al. 36397* (MO, NY, UB); Serra da Gramma, 1,700 m, erect among brush, slope above jungle, *Chase 9555* (F, GH, NY, US); without locality, *St. Hilaire 296* (P). PARANÁ: Mun. Gral. Carneiro, Rio Lageado, *Hatschbach et al. 13731* (K); Jaguariaiva, *Dusén 16390* (US); Ponta Grossa, *Dusén 2441* (R); Tres Barras, *Dusén 17531* (F, G, GH, NY, US); Capão da Imbuia, Curitiba, *Dombrowski 5835* (K); Road BR-2, Rio Palmital, Mun. Colombo, *Clayton 4305* (K). RIO DE JANEIRO:

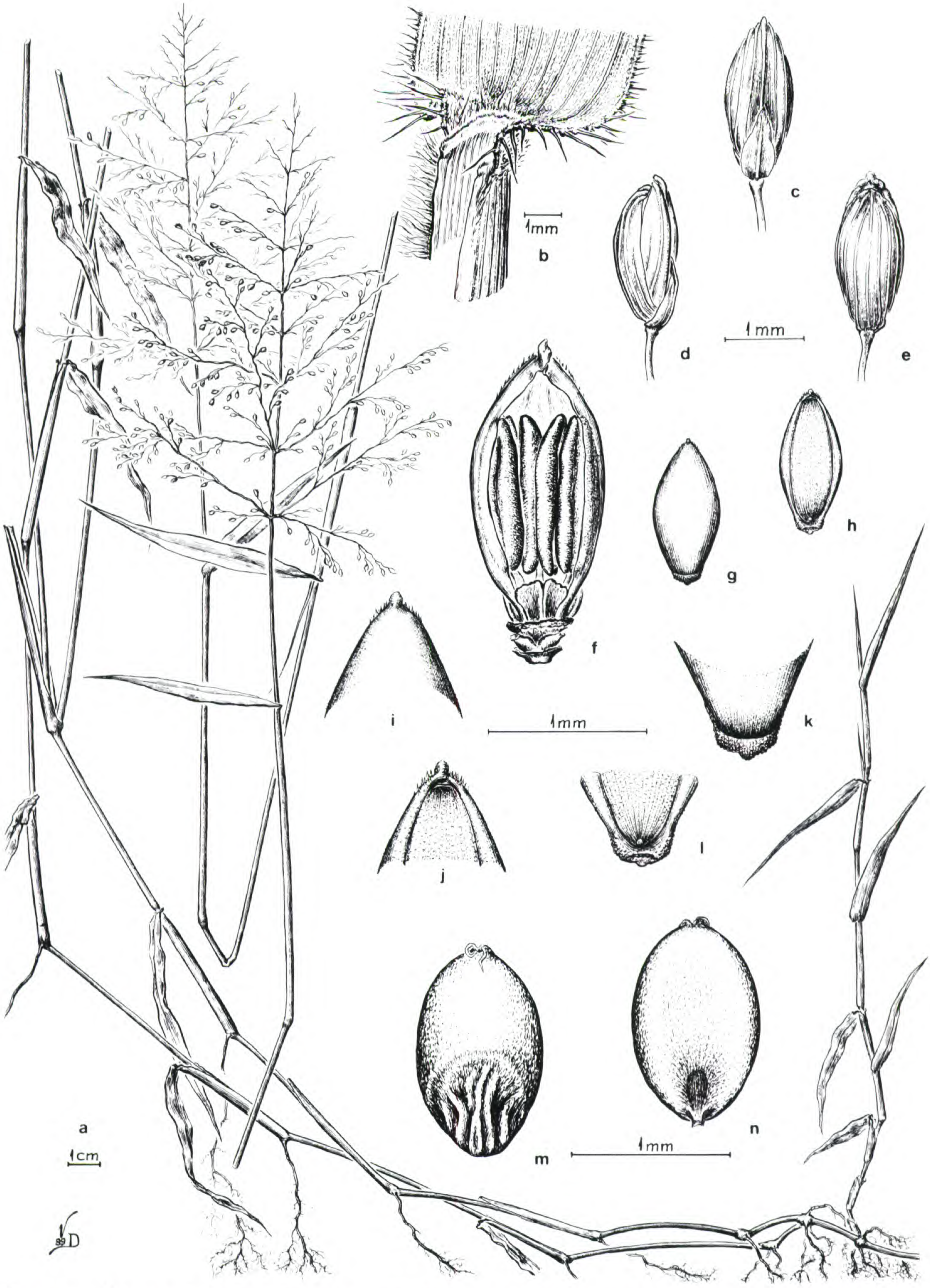

Figure 1. Holotype of *Panicum surrectum.* —a. Habit. —b. Detail of ligule. —c. Spikelet, ventral view. —d. Spikelet, lateral view. —e. Spikelet, dorsal view. —f. Lower palea with lower flower, stamens and lodicules. —g. Upper anthecium, dorsal view. —h. Upper anthecium, ventral view. —i. Detail of apex of the upper anthecium, lemma side. —j. Detail of apex of the upper anthecium, palea side. —k. Detail of base of the upper anthecium, lemma side. —l. Detail of base of the upper anthecium, palea side. —m. Caryopsis, embryo side. —n. Caryopsis, hilum side.

below Macieiras, Serra de Itatiaia, 1,700–1,800 m, open sunny place on mountain slope, *Chase 8324* (GH, NY, US). RIO GRANDE DO SUL: Taimbezinho, pantano, *Boechat s.n.* (ICN 41067). SANTA CATARINA: Rio Capinzal, *Dusén 17876* (US); Santa Cecilia, 1,100 m, *Reitz & Klein 11358* (US); Pôrto União, 750 m, *Reitz & Klein 12796* (US); Mun. Pôrto União, Fazenda Frei Rogério, 12 km SE of Pôrto União, 750 m, *Smith & Reitz 8710* (NY). SÃO PAULO: Serra Mantiqueira, Campos do Jordão, 1,580 m, ascending to erect from trailing base, open sandy campo, *Chase 9815* (F, NY, US), *9839* (NY, US), *Holway 1737* (US), *Leite 3510* (GH). Without locality, *Sellow 523* (US). PARAGUAY. CAAGUAZÚ: Caaguazú, *Balansa 7* (G).

Within section *Dichanthelium*, *P. surrectum* is related to *P. sabulorum* Lam., *P. stigmosum* Trin., and *P. superatum* Hackel. It differs by its narrowly ellipsoid spikelets and a usually smaller lower glume that does not embrace the upper glume. In *P. stigmosum*, *P. sabulorum*, and *P. superatum* the lower glume is ½ to ¾ the length of the spikelet and it covers the base of the upper glume, and the spikelets are ellipsoid to obovoid. Additionally, in *P. superatum* the panicles are contracted, with the spikelets congested on the branches, and *P. stigmosum* has usually larger spikelets, (2–)2.4–3.2 mm long, and leaves (8.3–)10–22 cm long.

Panicum surrectum has, as do other species of subgenus *Dichanthelium* (Morrone & Zuloaga, in press), conspicuous glands on the axis and pedicels of some individuals. Cleistogamous flowers with anthers 0.6 mm long were observed in the specimen *Chase 9815*. Cleistogamy is frequent in species of subgenus *Dichanthelium* from North America.

Renvoize (1988) misidentified the specimen *Hatschbach et al. 13731* and included it in *P. subtiliracemosum* Renvoize.

Mez described *P. missionum* in 1917 on the basis of the following specimens:

Panicum missionum Mez, Notizbl. Bot. Gart. Berlin 7: 74. 1917. Not Ekman 1912. SYNTYPES: Argentina. Misiones: San Pedro, cabeceras del Río Yobatí-Guazú, 9 Nov. 1886, *Niederlein 2062* (fragment US). Paraguay. Caaguazú: ad Caaguazú, *Balansa 7* (specimens at G, K, P). Brazil. Minas Gerais: in Sierra d'Estrella, *Beyrich s.n.* (fragment US); ad Contendas, *Kuntze s.n.*. Without locality, *Sellow 523* (fragment US).

The specimen *Niederlein 2062* from Argentina is *P. sabulorum* Lam. var. *polycladum* (E. Ekman) Palacios. The syntype *Beyrich s.n.* is *P. schawckeanum* Mez, a species of section *Parvifolia*. In US there is a fragment from B of *Sellow 523*, and A. Chase wrote a note on the specimen stating that the original citation of *Sellow 323* is probably a mistake; this fragment corresponds to *P. surrectum*. The original specimen was not found at B (H. Scholz, pers. comm.).

Regarding *Balansa 7*, the syntype of P is a mixture of material; a portion of the material is *P. sabulorum* and the other portion is *P. surrectum*. The syntype of this material from G is *P. surrectum*.

We were not able to locate the specimen collected by Kuntze.

Panicum peristypum Zuloaga & Morrone, sp. nov. TYPE: Brazil. Espírito Santo: Mun. Domingos Martins, Domingos Martins, selva en cerro del Dr. Kautsky, 600–850 m, 7 May 1985, *Zuloaga et al. 2398* (holotype, RB; isotypes, MO, SI, US). Figure 2.

Laminae ovatae-lanceolatae, basi cordatae, amplexicaules. Spiculae anguste ellipsoideae, 2.4–2.5 mm longae; gluma inferiore 1.2–1.4 mm longa, glumae superioris basim non amplectente; gluma superiore (7–)9-nervia; lemmate inferiore 9-nervio. Flos inferior absens. Anthoecium superior ellipsoideum, 2.2 mm longum, lemmate minute cristato.

Shortly rhizomatous perennials. *Culms* decumbent and rooting at the lower nodes, then erect, ca. 80 cm tall; internodes 7–12 cm long, compressed, striate, glabrous; nodes compressed, glabrous, brownish. *Sheaths* striate, 5–9(–18) cm long, usually shorter than the internodes, glabrous, shiny, the margins membranous, ciliate toward the distal portion. *Ligules* 0.3 mm long, membranous at the base, then shortly ciliate; collar shortly pubescent. *Blades* ovate-lanceolate, 7–15 cm long, 1.5–3 cm wide, cordate, amplexicaulous, acute, velutinous, the lower margins long-ciliate, otherwise ciliate. *Inflorescences* terminal, exserted; *panicles* lax, diffuse, 15 cm long, 8 cm wide; *main axis* sparsely pilose, without glands, the pulvini pilose; first-order branches alternate to subopposite, the axis of the branches scabrous, flexuous, without glands; pedicels claviform, flexuous, scaberulous. *Spikelets* narrowly ellipsoid, 2.4–2.5 mm long, 1 mm wide, non-stipitate, glabrous, greenish or tinged with purple; upper glume and lower lemma subequal. *Lower glume* ovate, 1.2–1.4 mm long, ½ or a little more the length of the spikelet, glabrous, 1–3-nerved, not embracing the upper glume. *Upper glume* 1.9–2.3 mm long, (7–)9-nerved, with manifest nerves, not covering the tip of the upper anthecium. *Lower lemma* gluminform, 2–2.3 mm long, 9-nerved. *Lower palea* lanceolate, 1.7 mm long, 0.4 mm wide, hyaline, glabrous. *Lower flower* absent. *Upper anthecium* ellipsoid, 2.2 mm long, 0.8 mm wide, indurate, papillose; lemma crestate, scaberulous. *Upper flow-*

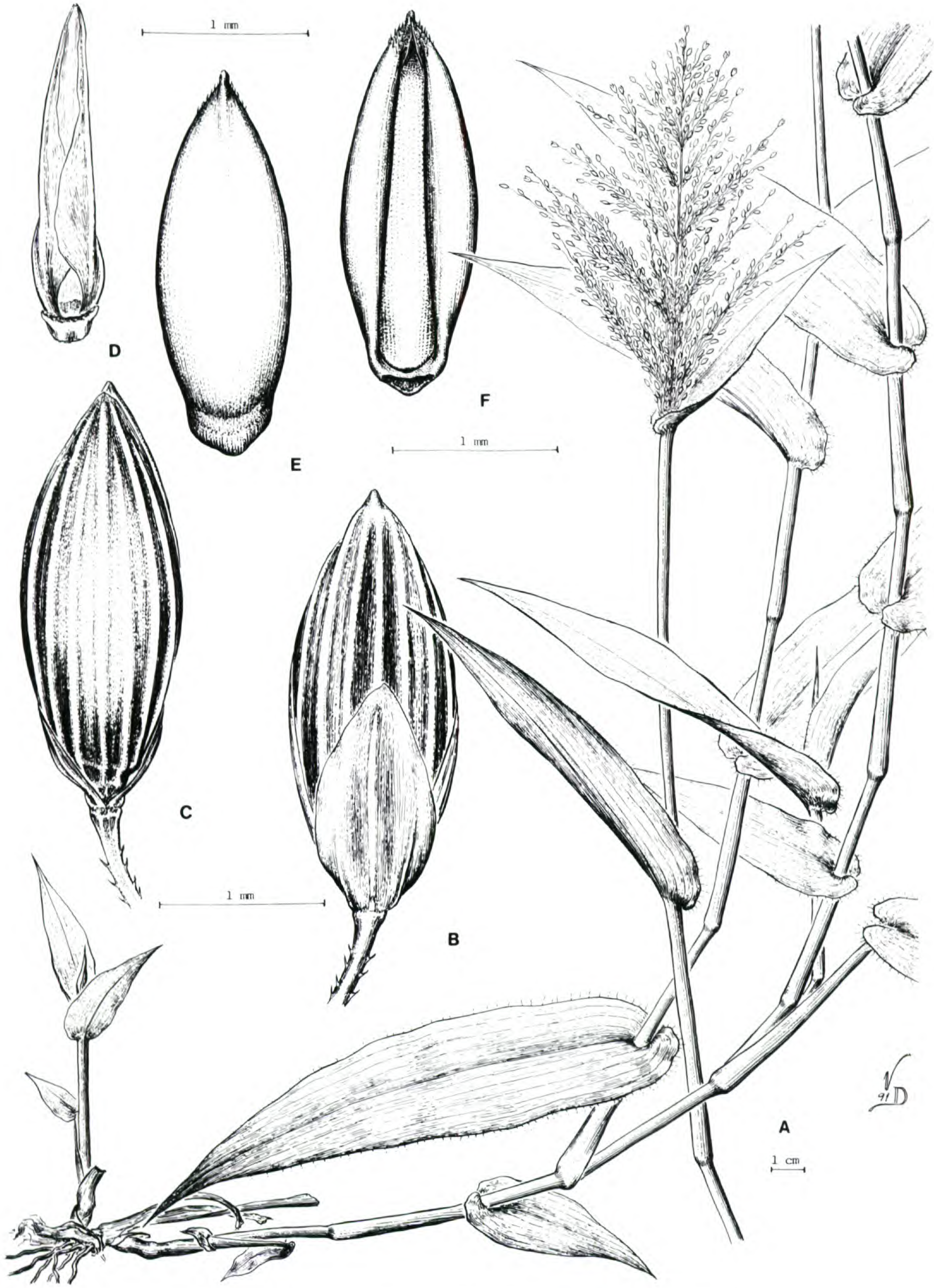

Figure 2. Isotype of *P. peristypum*. —A. Habit. —B. Spikelet, ventral view. —C. Spikelet, dorsal view. —D. Lower palea. —E. Upper anthecium, dorsal view. —F. Upper anthecium, ventral view.

er bisexual; stamens 3, the anthers 1.4 mm long; styles 2, free; stigma pink. *Caryopsis* not seen.

Distribution and ecology. Known only from the type collection on forest edges in the state of Espírito Santo, Brazil, 650–800 m.

Related to *P. sciurotoides*, *P. peristypum* has leaves 1.5–3 cm wide and amplexicaulous, spikelets 2.4–2.5 mm long, and a lower palea 1.7 mm long. It differs from *P. sabulorum* and *P. stigmosum* in its narrowly ellipsoid spikelets (obovoid in *P. sabulorum* and *P. stigmosum*), lower glume not embracing the upper glume at its base, and the lack of a short stipe between the lower and upper glume. Furthermore, *Panicum peristypum* lacks the foliar dimorphism present in *P. sabulorum* and, in contrast to *P. stigmosum*, has amplexicaulous leaves.

Panicum sabulorum Lam., Encycl. 4: 744. 1798. *Dichanthelium sabulorum* (Lam.) Gould & C. A. Clark, Ann. Missouri Bot. Gard. 65: 1112. 1978. TYPE: Uruguay. Montevideo: Montevideo, *Commerson s.n.* (holotype, P; isotypes, R, US, fragment BAA).

Short-rhizomatous perennials. *Culms* dimorphic: young culms simple, erect and with broad, cordate, lanceolate leaves, older culms erect to decumbent, occasionally rooting and profusely branching at the lower and upper nodes, up to 1 m long, with the leaves smaller than those of the simple culms; internodes hollow, cylindric, hirsute; nodes densely pilose to glabrous, dark. *Sheaths* 2.5–6 cm long, hirsute to glabrous, the margins ciliate, glands present or absent, more conspicuous toward the distal portion. *Ligules* membranous-ciliate, 0.4–1.1 mm long; collar pilose or glabrous. *Leaves* lanceolate, 1–9(–15) cm long, 0.2–1.4(–2) cm wide, flat, subcordate to cordate, amplexicaulous, acuminate, rigid to herbaceous, pubescent, with short, stiff hairs or with papillose-pilose hairs or glabrous, the lower margins long-ciliate, otherwise scabrous, the midnerve inconspicuous. Primary *inflorescences* lax, diffuse, few to multiflowered, 2–10 cm long, 2–8 cm wide; *main axis* hirsute or glabrous, with or without glands; first-order branches alternate, divergent, the axis of the branches long-hirsute to scabrous and with or without glands; spikelets paired or solitary on claviform pedicels; pedicels hirsute and with or without glands. Axillary panicles similar to the terminal one but smaller. *Spikelets* obovoid, biconvex, 1.9–3 mm long, 0.9–1.4 mm wide, shortly stipitate, greenish and tinged with purple, hirsute to glabrous; glumes and lower lemma with manifest nerves. *Lower glume* 3–5-nerved, ½–¾ the length of the spikelet, ovate, obtuse to acute and embracing the upper glume on its base, the nerves anastomosed toward the apex. *Upper glume* 7–9-nerved, obtuse, not covering the apex of the upper anthecium. *Lower lemma* glumiform, 7–9-nerved. *Lower palea* ovate, 1.6 mm long, 0.8 mm wide, hyaline, the margins short-ciliate. *Lower flower* male or absent. *Upper anthecium* broadly ellipsoid, 1.8–2.5 mm long, 0.7–1.2 mm wide, stramineous, shiny, shortly apiculate, with simple papillae in regular rows; lemma 5-nerved. *Upper flower* bisexual; lodicules 2, truncate and embracing the lower margins of the palea; stamens 3, styles 2, free, stigma purplish. *Caryopsis* broadly ellipsoid, 1.5 mm long, 1 mm wide; hilum punctiform; embryo less than half the length of the caryopsis.

Key to the Varieties

1a. Blades amplexicaulous ..... var. *cordatum*
1b. Blades not amplexicaulous.
  2a. Spikelets (2.2–)2.4–3 mm long, pilose; blades pilose; plants growing in open, dry places ..... var. *sabulorum*
  2b. Spikelets 1.9–2.3(–2.6) mm long, glabrous or sparsely pilose; blades glabrous; plants growing at edge of forest in humid places ..... var. *polycladum*

Panicum sabulorum Lam. var. **sabulorum**

P. acutatum Steudel, Syn. Pl. Glumac. 1: 86. 1854. TYPE: Chile. Concepción: Concepción, *D'Urville s.n.* (holotype, P, fragments BAA, US-80445).

P. latiglume Doell, in C. Martius, Fl. Bras. 2 (2): 257. 1877. *P. latiglume* var. *villosum* Doell, in C. Martius, Fl. Bras. 2 (2): 257. 1877. *P. latiglume* Doell f. *villosum* (Doell) E. Ekman, Ark. Bot. 13(10): 28. 1913. TYPE: Brazil. Santa Catarina: Isla de Santa Catarina, *Gaudichaud 90* (isotype, P, fragment US-80869).

P. latiglume Doell var. *decalvatum* Doell, in C. Martius, Fl. Bras. 2 (2): 257. 1877. *P. demissum* Trin. f. *decalvatum* (Doell) E. Ekman, Ark. Bot. 13(10): 28. 1913. TYPE: Brazil. Santa Catarina: Isla de Santa Catarina, *Gaudichaud 91* (fragment US-80869).

P. fultum Hackel, Repert Spec. Nov. Regni Veg. 6: 342. 1909. SYNTYPES: Uruguay. Montevideo: Montevideo, arenales de la Barra de Santa Lucía, *Arechavaleta s.n.* (syntype, W; isosyntype, G, fragment of the syntype, BAA). Paraguay. Cordillera: in campis prope Caraguatay, *Hassler 3124* (syntype, W; isosyntypes, G, NY, fragment of the syntype, BAA).

Selected specimens examined. ARGENTINA. BUENOS AIRES: Balcarce, *Hunziker 2166* (SI). CORRIENTES: La Cruz, *Burkart 7943* (SI); ruta nac. 12, 20 km E de Ituzaingó, *Zuloaga et al. 3231* (SI); Cuay Grande, *Lourteig et al. 2884* (CTES, SI). ENTRE RÍOS: Colón, Ea. La Poli, *Troncoso et al. 2670* (SI); Arroyo El Palmar, *Burkart & Crespo 22927* (SI), *Zuloaga & Morrone 3857* (MO, SI); Palmar Grande, *Nicora 3067* (LIL, SI); Ayuí,

Troncoso et al. 2020, 2707, 2709, 2802 (all SI); Colonia Ayuí, *Bacigalupo et al. 1031* (SI), *Zuloaga & Morrone 3852* (MO, SI); Concordia, *Parodi 3922* (P, SI); ruta 12, desvío a Holt, Arroyo El Cuartillo, *Zuloaga 3864* (MO, SI); Santa Ana, *Renvoize et al. 2929* (MO, P, SI); Calabacilla, desvío a Nueva Escocia, *Bacigalupo et al. 847* (SI). CHACO: Isla del Cerrito, *Krapovickas et Cristóbal 20048* (CTES). BRAZIL. PARANÁ: Colônia Orleas, Curitiba, *Dombrowski 1958* (CTES); Mun. 4 Barras, Rio Taquarí, prox. Estr. Graciosa, *Hatschbach 35525* (K). RIO DE JANEIRO: Petrópolis, Carangola, *Goes & Dionisio 417* (US). RIO GRANDE DO SUL: Taimbesinho, prope São Francisco de Paula, *Rambo 54532* (US); Mun. Rio Pardo, Fazenda Soledad, *Jürgens 109* (US, W); 3 km W of Torres, *Beetle 1911* (MO); Vila Diehl, São Leopoldo, *Dutra 646* (R, US), *Canisio 365* (R, US), *Rambo 44279* (LIL, NY); Rio Grande, *Swallen 9252* (US); Fazenda Leitão, *Jürgens 9327* (US); Porto Alegre, *Malme 422, 435* (US), *Orth 5* (US); São Leopoldo, Collegio Cristo Rei, *Beetle 1972* (MO); Lages, *Swallen 8140* (US). SANTA CATARINA: Sombrío, *Reitz 1978* (NY); Serra dos Ilheos, *Smith & Klein 15464* (NY, SI). SÃO PAULO: Cananeia, Ilha do Cardoso, Praia do Marujá, *da Silva 249* (MO); São Paulo, Parque do Estado, *Sendulsky 842* (SI, SP); Santos, *Sendulsky 739* (SI, SP). CHILE. CONCEPCIÓN: Concepción, *D'Urville 1821* (P), *Gay s.n.* (P). MAULE: without locality, Dec. 1911, *Fuentes s.n.* (W). PARAGUAY. Cordillera de Piribebuy, au desus de Mbatobí, *Balansa 4202* (P). PARAGUARÍ: Paraguarí, *Balansa 8*, (G, K. P). URUGUAY. CANELONES: Ruta Interbalnearia Km 51, Arroyo Solís Chico, *Dubcovsky 834, 835, 836, 837* (all SI); Carrasco, *Burkart 19982* (SI), *Osten 6917* (W); *Herter 324* (G, MO, NY, SI); Bañado del Negro, cerca del Arroyo Pando, *Rosengurtt 11329* (NY). MONTEVIDEO: Montevideo, *Arechavaleta 144* (W), *Montoro 2667* (P); Montevideo, *D'Orbigny 8* (W). ROCHA: La Paloma, *Zuloaga & Deginani 1081* (SI). SALTO: Granja Catáneo, *Rosengurtt B-6217* (SI). TACUAREMBÓ: Camino a Ribera, a 32 km de Tacuarembó, *Cabrera & Zuloaga 32424, 32425* (both SI); Estancia El Rincón, *Galland 55* (G).

In variety *sabulorum* the spikelets are pilose and (2.2–)2.4–3 mm long, the axis of the inflorescence is hirsute, and the blades are rigid and hirsute. Variety *sabulorum* usually inhabits open and dry places, in sandy soils.

Nuñez (1952) reported a chromosome number of $2n = 54$ for one of the synonyms of this variety, *P. fultum*. A similar chromosome number was found in several populations of variety *sabulorum* from Argentina and Uruguay by Dubcovsky & Zuloaga (in press).

Panicum sabulorum Lam. var. **polycladum** (E. Ekman) Palacios, in Burkart, Fl. Il. Entre Ríos, 6(2): 316. 1969. *P. polycladum* E. Ekman, Ark. Bot. 11(4): 24. 1912. TYPE: Argentina. Misiones: Bonpland, 27 Jan. 1908, *Ekman 651* (holotype, S, fragment US-80923; isotype, CORD).

P. demissum Trin., Sp. Gram. 3: pl. 319. 1836. *Panicum demissum* Trin. f. *genuinum* (Doell) E. Ekman, Ark. Bot. 13(10): 28. 1913, nom. illeg. TYPE: Brazil. Rio de Janeiro: Rio de Janeiro, *Martius s.n.* (holotype, LE, fragment US-557430).

P. ramosissimum Trin., Mém. Acad. Imp. Sci. St.-Petersbourg., Sér. 6, Sci. Math. 1: 312. 1834. TYPE: Brazil: without locality, *Sellow s.n.* (holotype, LE, fragment US-974731).

P. pencanum Philippi, Anales Univ. Chile 93: 713. 1896. TYPE: Chile. Concepción: Concepción, 1888, *Philippi s.n.* (isotype, CORD, fragments BAA, US).

P. deltae L. Parodi ex Burkart, Bol. Soc. Argent. Bot. 12: 291. 1968. TYPE: Argentina. Buenos Aires: Delta del Paraná inferior bonaerense, arroyo Chaná Miní, 14 Jan. 1923, *Parodi 4928* (holotype, SI; isotypes, BAA, US-1160950).

Selected specimens examined. ARGENTINA. BUENOS AIRES: Tigre, *Burkart 275* (SI); Isla Santiago, *Spegazzini s.n.* (SI-13457); Delta of Río Paraná, sec. I, Las Palmas, Recreo Naón, *Eyerdam et al. 23132* (G, US); Punta Lara, *Zuloaga & Deginani 1891, 3085* (both SI), *3859, 3861* (both SI); Cerro La Peregrina, 20 km N of Mar del Plata, *Eyerdam et al. 23678* (MO, SI, US); Escobar, Paraná de Las Palmas, *Zuloaga & Morrone 3079, 3860* (both SI), *4543, 4544* (both MO, SI); La Movediza, *Pastore 1227* (SI). CÓRDOBA: Pie de los Gigantes, camino a Taninga, *Burkart 20801* (SI); W of Tanti at Rancho Alegre, *Renvoize 3743* (K, SI); between Cerro Blanco and La Hollada, ruta nac. 20, km 767, *Solomon 4091* (MO). CORRIENTES: Puente Pesoa, *Quarín 1744* (CTES, SI); Isla Apipé Grande, Puerto San Antonio, *Krapovickas et al. 23817* (CTES, SI); ruta nac. 12, 20 km E de Ituzaingó, *Zuloaga et al. 3228* (SI); 75 km N de Mercedes, Laguna Trin, *Quarín et al. 3171* (CTES, SI); San Cosme, *Parodi 12032* (BAA, SI); Santo Tomé, Río Aguapey y ruta 14, *Quarín et al. 2655* (CTES, SI). DISTRITO FEDERAL: Belgrano, *Burkart 3617* (SI). ENTRE RÍOS: Colón, Concordia, Est. Exp. INTA, *Burkart et al. 29692* (SI); Brazo Largo inferior, Delta del Paraná, Isla la Chilena, *Burkart 8936, 8937* (both SI); Pto. Constanza, *Burkart & Troncoso 26208* (SI); Concepción del Uruguay, Arroyo La China, *Zuloaga et al. 3088* (SI); de Calabacilla a Nueva Escocia, *Zuloaga & Morrone 3846* (SI); Nueva Escocia, *Bacigalupo et al. 871* (SI). FORMOSA: without locality, *Kermes 346* (SI). JUJUY: Yala, cerros, *Burkart & Troncoso 11280* (SI), *Zuloaga & Deginani 3409* (SI); Quebrada de Yala, *Cabrera et al. 23574* (SI); Santa Bárbara, *Venturi 9545* (SI, US, W), *9691* (US). MISIONES: Apóstoles, *Renvoize 3150* (K, MO, P); Jardín América, *Zuloaga & Deginani 463* (SI); Villa Venecia, *Renvoize et al. 3034* (P, SI); ruta prov. 105, entre Santa Ana y Oberá, *Mroginski 435* (CTES, G), *437* (CTES, MO), *441* (CTES); camino a Loreto, 2 km de la ruta nacional 12, *Zuloaga et al. 3189* (SI); casa de Horacio Quiroga, *Zuloaga et al. 3191* (MO, SI); La Granja, Posadas, *Ekman 645* (G, US); ruta nac. 14, pasando San Pedro, *Zuloaga et al. 765* (SI). SALTA: Cerro Pelado Chiquito, Parque Nac. El Rey, *Malmierca 2006* (SI); Depto. Rosario de Lerma, Campo Quijano, *Venturi 8428* (US); Campo Quijano, *Burkart 13029* (SI). BOLIVIA. COCHABAMBA: Comarapa to Cochabamba, *Renvoize & Cope 4072* (K, US). SANTA CRUZ: entre Comarapa y Pojo, *Zuloaga et al. 1579* (SI). BRAZIL. ESPÍRITO SANTO: Serra do Caparão, *Chase 9680* (MO), *9731* (US, W). MINAS GERAIS: Serra do Itabirito, ca. 50 km SE of Belo Horizonte,

Irwin et al. 19715 (MO, NY); Barbacena, Serra Mantiqueira, *Chase 8646* (NY, US), *8674* (US); Hargreaves, 1,300–1,400 m, *Chase 10253* (US); ca. 30 km SW of Campanha along highways 267 and 381 to São Paulo, *Davidse & Ramamoorthy 10620* (MO). PARANÁ: Serra do Mar, *Dusén 16127* (K, MO); Passa Vinte, *Clayton 4269* (K, NY, US); Mun. São Jose dos Pinhais, Guaricana, *Hatschbach 38037* (K); 10 km from Passa Vinte on Curitiba road, *Clayton 4280* (K); Mun. Jaguariaiva, Rio Jaguariaiva, Barra do Mortes, *Hatschbach 12293* (K); Mun. Matinhos, Praia dos Ferroviarios, *Kummrov 829* (K); Bariguy, *Dusén 15766* (MO); 8 km of the Paraná–Santa Catarina border at the Rio Negro, *Davidse et al. 11020A* (MO); 2 km E of Cascavel along highway BR-277 to Curitiba, *Davidse et al. 11255* (MO, SI, US); Curitiba, Serrinha, *Dusén 15565* (MO, US), 10 km NW of Palmas, *Smith et al. 15629* (P, R, US); Baryguy, in campo, *Dusén 15767* (US); Ponta Grossa, *Swallen 8419* (US); Porto Amazonas, 5 km N, *Hatschbach 43562* (NY). RIO GRANDE DO SUL: Morro Santa Teresa, Porto Alegre, *Clayton 4371* (K); 12 km N of Santa Ana, *Archer 4440* (K, NY); São Francisco de Paula, *Clayton 4466* (K, NY); Arroio Grande, Canela, *Barreto 2003, 2008* (both SI); Ilha dos Marmheiros, *Capanema 5396* (RB, US); Pelotas, *Costa Sacco 202* (HB, SI), *Swallen 7034, 7211* (both US); Porto Alegre, Morro da Gloria, *Rambo 29194* (US); Nova Petrópolis, km 100 da BR-116, ao N da ponte sobre o Rio Caí, *Valls et al. 1664* (CEN, ICN, SI); Mun. Rio Pardo, Fazenda Boa Esperança, *Jürgens 61b* (W); Rosario do Sul, Rio Santa Maria, *Krapovickas et al. 22801* (CTES); Bom Jesus-Borda dos Aparados da Serra, *Valls & Arzivenco 1398* (CTES, US); Canela, Sitio, *Valls 1178* (CTES); entre Sta. Rosa e Giruá, 13 km apos Sta. Rosa, *Valls et al. 1809* (CEN, CTES); Parecí Novo, *Schnem 1605* (SI); Taimbesinho, *Rambo 54088* (US); Arroio Grande, *Pereira 6732* (RB). RIO DE JANEIRO: Petrópolis, *Sucre et al. 4187* (SI); Corcovado, *Boelcke 6795* (SI), *Chase 8159* (MO, NY); Petrópolis, Grota do Jaco; Patí do Alferes, *Sucre et al. 9087* (RB); Petrópolis, estrada Fazenda Inglesa-Patí do Alferes, *Plowmann & Martinelli 10139* (MO); S of Petrópolis, Alto da Serra, *Chase 9769* (US); Parque Nac. Itatiaia, picada Macieiras, *Zuloaga et al. 2352* (RB, SI, US), *Chase 8267* (RB, US), *8268* (US); Parque Nac. Itatiaia, Rio Campo Belho, *Zuloaga et al. 2361* (RB, SI, US); Serra dos Orgãos, 16 km S of Itaipara, *Davidse et al. 11422* (MO); Teresópolis, *Sampaio 1608* (R); Rio de Janeiro, *Riedel s.n.* (W); Chemin de Nova Friburgo, *Glaziou 4305* (MO, US). SANTA CATARINA: 4 km S of Xanxeré, *Smith & Klein 13066* (K, SI); Campo Alegre, *Reitz & Klein 5157* (US) Barra Macaco Branco, *Smith & Reitz 12712* (K, P, US); 3 km W of Campo Alegre, *Smith & Klein 12792* (US); W of Chapecó on road to Guatambú, *Smith & Reitz 12534* (K, R, US); 18 km N of Curitibanos, *Smith & Klein 15491* (K, R, US); Marombinhas, *Smith & Klein 15478* (K, SI, US); 10 km E of Poco Preto, *Smith & Klein 15737* (K, SI, US); 10 km S of São Joaquim, *Smith & Reitz 14305* (K, NY, SI, US); Campo dos Padres, Bom Retiro, *Reitz 2595* (SI, US). SÃO PAULO: Campos do Jordão, Serra Mantiqueira, *Chase 9894* (US); city of São Paulo, bairro of Agua Funda, *Eiten & Eiten 6236* (MO); São Paulo, Parque do Estado, *Sendulsky 711, 1058* (SI, SP); Campos da Bocaina; Campos do Jordão, Umuarama, *Kuhlmann 2044* (SI); Apiahy, *Glaziou 16555* (P, US). CHILE. Taleamavida, *Barros 291* (SI). MAULE: ad rivulos pr. Constitución, *Reiche s.n.* (W). PARAGUAY. Encarnación, *Pavetti & Rojas 10855* (US). CAAGUAZU: in viciniis Caaguazú, *Balansa 4a* (K, P), Mar. 1905, *Hassler 9212* (G, K, NY, US). CORDILLERA: Eusebio Ayala, *Schinini 2583* (CTES, SI); San Bernardino, costa del Lago Ypacaraí, *Quarín et al. 1593* (G, K, SI). GUAIRÁ: Villa Rica, *Balansa 5* (G), *5a* (P). SAN PEDRO: Primavera, *Woolston G-117* (NY). URUGUAY. CANELONES: Toledo, *Osten 20083* (US). FLORIDA: Río Yí y Arroyo Mansavillagra, *Rosengurtt B-739* (US); La Palma, *Herter 1153* (US). MALDONADO: Cerro Pan de Azucar, *Rosengurtt B-2722* (US); Cerro Animas, *Rosengurtt B-5077* (US). MONTEVIDEO: Montevideo, Barra del Santa Lucía, *Arechavaleta 267* (US); Montevideo, balneario Carrasco, *Osten 6511* (SI). ROCHA: Parque San Miguel, *Rosengurtt & Del Puerto 9253* (US). SAN JOSÉ: Río Santa Lucía, próximo al pueblo "25 de Agosto," *Rosengurtt B-247* (US); Arazatí, *Rosengurtt s.n.* (US). SORIANO: Isla Redonda, *Berrio 6350* (W); Ea. Juan Jackson, *Rosengurtt B-241* (US). TACUAREMBÓ: Ruta 5, al norte de la ruta a Clara, *Rosengurtt 6930* (SI); Gruta de los Cuervos, *Cabrera & Zuloaga 32393* (SI).

This variety differs from variety *sabulorum* by its smaller spikelets, 1.9–2.3(–2.6) mm long and glabrous or with scattered hairs toward the apex, blades herbaceous and usually glabrous, and panicles with the main axis and branches commonly glandular. It usually grows in humid and shady places, on forest edges or near streams.

Variety *polycladum* has a chromosome number of $2n = 36$ (Dubcovsky & Zuloaga, in press, and Nuñez, 1952, under *P. sabulorum*).

Panicum sabulorum Lam. var. **cordatum** Zuloaga & Morrone, var. nov. TYPE: Brazil. Paraná: Carvalho, *Dusén 13336* (holotype, US; isotype, W).

A var. *sabulorum* laminis cordatis, amplexicaulibus differt.

Paratypes. BRAZIL. PARANÁ: Serrinha, *Jönsoon 1076a* (US), *Dusén 15596* (NY, US); Trancheira, *Jönsoon 1099a* (US). SANTA CATARINA: Mun. Praia Grande, *Valls 10087* (CEN, SI).

Variety *cordatum* has spikelets glabrous, 2–2.2 mm long, axis of the inflorences glabrous and with glands, sheaths with glands and blades amplexicaulous, cordate, asymmetric at base, glabrous, up to 15 cm long and up to 2 cm wide.

Distinctions among the new species and related ones are summarized in the following key:

1a. Spikelets narrowly ellipsoid, not globose and without a stipe between the lower and upper glume; lower glume ⅓(–¾) the length of the spikelet, not embracing the upper glume 2
2a. Blades linear-lanceolate, 5–12 cm long, 0.6–1 cm wide, attenuate at the base, not amplexicaulous ..... *P. surrectum*
2b. Blades ovate-lanceolate, 3-15 cm long, 0.8-3 cm wide, cordate, amplexicaulous 3

3a. Inflorescences 15 cm long; spikelets 2.4–2.5 mm long, glabrous ..... *P. peristypum*

3b. Inflorescences 2.5–9 cm long; spikelets 1.5–1.9 mm long, shortly hispid ..... *P. sciurotoides*

1b. Spikelets ellipsoid to obovoid, shortly stipitate between the lower and upper glume; lower glume ½–¾ the length of the spikelet, embracing the upper glume 4

4a. Inflorescences contracted, spiciform or with the branches divergent and the spikelets congested on the branches .... *P. superatum*

4b. Inflorescences lax, diffuse, the branches divergent and the spikelets not congested ... 5

5a. Plants leaning on vegetation, without foliar dimorphism; blades (8–)10–22 cm long; inflorescences 9–21 cm long, spikelets (2–)2.4–3.2 mm long, glabrous ..... *P. stigmosum*

5b. Culms erect to decumbent, not leaning on vegetation, with foliar dimorphism; blades 1–9(–15) cm long, inflorescences 2–10 cm long; spikelets 1.9–3 mm long, pilose or glabrous ..... *P. sabulorum*

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Nomenclatural Conspectus of Annual Eriophyllinae (Asteraceae)

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For a treatment of the annual taxa of *Eriophyllum* and the other, annual genera of Eriophyllinae (*Lembertia*, *Monolopia*, *Pseudobahia*, and *Syntrichopappus*) in the forthcoming flora of California, the *Jepson Manual*, the following conspectus provides nomenclatural information.

Eriophyllinae Rydb., N. Amer. Fl. 34: 81. 1915, as "Eriophyllanae." TYPE: *Eriophyllum* Lagasca.

Eriophyllum Lagasca, Gen. Sp. Pl. 28. 1816. *Bahia* Lagasca sect. *Eriophyllum* (Lagasca) Benth., Gen. Pl. 2: 403. 1873. Lectotype, selected by Gray (1883: 24): *E. staechadifolium* Lagasca, Gen. Sp. Pl. 28. 1816. TYPE: U.S.A. California: Monterey County, Monterey, "Hab. in Nov. Hisp. [protologue]," 13–23 Sep. 1791 (McKelvey, 1955: 18), *T. Haenke* (holotype destroyed in 1823 (Burdet, 1976: 149); isotype, G-DC).

Trichophyllum Nutt., Gen. N. Amer. Pl. 2: 166. 1818. *Eriophyllum* sect. *Trichophyllum* (Nutt.) A. Gray, Proc. Amer. Acad. Arts 19: 25. 1883. Lectotype, selected here: *Actinella lanata* Pursh, Fl. Amer. Sept. 560. 1814. *T. lanatum* (Pursh) Nutt., Gen. N. Amer. Pl. 2: 167. 1818. *E. lanatum* (Pursh) James Forbes, Hort. Woburn. 183. 1833. *Phialis* Sprengel, Gen. Pl., ed. 9, 2: 631. 1831, listing *Trichophyllum* in synonymy, name superfluous. TYPE: U.S.A. Idaho: Idaho County, "Uplands of Kooskooskee [holotype label, i.e., Clearwater River, Camp Chopunnish, near present town of Kamiah (Cutright, 1969: 401)]," 6 June 1806, *M. Lewis* (holotype, PH; isotype, PH). —Although *Index Nominum Genericorum* (Farr et al., 1979: 1789) indicates that *Trichophyllum* was lectotypified by Rydberg (1901), it was not, nor was it subsequently, so it is lectotypfied here.

Eremonanus I. M. Johnston, Contr. Gray Herb. 68: 101. 1923. TYPE: *Eriophyllum mohavense* (I. M. Johnston) Jepson.

(Additional generic synonymy is given under *Eriophyllum* sect. *Actinolepis* and *E.* sect. *Antheropeas*, below.)

Constance (1937), Carlquist (1956), and Mooring (1986) have given accounts of the perennial taxa, which constitute *Eriophyllum* sect. *Eriophyllum*. The annual taxa may be divided into three sections: *Actinolepis*, *Antheropeas*, and *Pseudomonolopia*.

Eriophyllum sect. **Actinolepis** (DC.) A. Gray, Proc. Amer. Acad. Arts 19: 24. 1883. *Actinolepis* DC., Prodr. 5: 655. 1836. TYPE: *E. multicaule* (DC.) A. Gray.

The three species of section *Actinolepis* are similar in having a disk corolla of a cylindrical tube abruptly dilated into a broad cylindrical throat; glandular disk corolla lobe trichomes (in this character they are similar to section *Antheropeas*); deltoid, distally tapering stamen connective tips; and blunt style tips, wider at the base than the stigmatic portion of the branches.

Eriophyllum mohavense (I. M. Johnston) Jepson, Man. Fl. Pl. California 1117. 1925. *Eremonanus mohavensis* I. M. Johnston, Contr. Gray Herb. 68: 101. 1923. TYPE: U.S.A. California: San Bernardino County, "In collibus saxosis pr[ope] Barstow [holotype label]," 1 May 1922, *M. F. Spencer 1949* (holotype, GH; isotypes, POM, US). —The locality "Ord's Mountain . . . on the high bench near the east bank of the Mohave river nearly opposite the Santa Fe passenger station in Barstow" is given in the protologue, but "Ord Mountain is a very huge mountain a full day's trip [29 km] southeast of Barstow [W. L. Jepson to F. G. Woodcock, 9 July 1925, in Jepson Correspondence 19: 538 (JEPS)]." Woodcock, who was present during the collection of the type, wrote, "The name 'Ord's Mountain' was given to me after my return to San Diego. . . . If the statement is contradictory, it is from my lack of knowledge of the name of the mountain," adding, "the locality was back of Mrs. Iverson's Ranch about 2 miles out [west from Barstow] on the Hinkley Road [to Jepson, 3 June 1925, in Jepson Correspondence 19: 537 (JEPS)]." After much searching, Jepson found the plant on "Iverson

Hill" (*Jepson 17180a*: DS, JEPS, RSA), which may be the type locality. I located this site in 1975 at 1.8 km west of the junction with Camp Irwin Road on the north side of the Hinkley–Yermo road (50°54′38″N, 117°2′33″W on U.S. Geol. Surv. 15′ Barstow quadrangle, 1956).

Eriophyllum multicaule (DC.) A. Gray, Proc. Amer. Acad. Arts 19: 24. 1883. *Actinolepis multicaulis* DC., Prodr. 5: 656. 1836. TYPE: U.S.A. California: "1833 [i.e., 22 Dec. 1830–18 Aug. 1832]," *D. Douglas* (holotype, G-DC; probable isotypes (numbered *21*), BM, W; possible isotypes (unnumbered), DS, GH, NY). —For more information on locality and date of Douglas's California collections, see discussion of the type of *Monolopia major*, below.

Actinolepis multicaulis var. *papposa* A. Gray, Proc. Amer. Acad. Arts 6: 546. 1865. TYPE: U.S.A. California: Santa Barbara County, "Dry plain of Santa Maria Valley [lectotype label]," 9 Apr. 1861, *W. H. Brewer 404* (lectotype, selected here, GH; isolectotypes, UC, US). —In the protologue, Gray mentioned collections by Brewer from "three stations, all in Santa Barbara County." All three collections are mounted on one sheet in GH. However, *499* (30 Apr. 1861, "Atascadero") actually comes from San Luis Obispo County, and *352* (26–30 Mar. 1861, "Sta. Inez [i.e., Santa Ynez] Mountains"), although from Santa Barbara County, is indistinguishable from *499* because of ambiguous positioning of specimens and Gray's (?) penciled numbers. Therefore, *404*, the "more woolly form gathered in Santa Maria Valley [protologue]" on the day Brewer traveled from the ranch of W. B. Foxen, ca. 40 km southeast of Santa Maria (Brewer, 1966: 77–78; Hoover et al., 1966: 422), to Nipomo, near the southern border of San Luis Obispo County and northwest of Santa Maria, is chosen as lectotype. It is likely that Brewer collected *404* on the broad plain south of the Santa Maria River and thus in Santa Barbara County. Information on dates of collection is derived from a copy of a copy (sic) of Brewer's original field notes at GH, prepared by A. V. Stubenrauch in October 1897 and deposited in UC.

Eriophyllum pringlei A. Gray, Proc. Amer. Acad. Arts 19: 25. 1883. *Actinolepis pringlei* (A. Gray) E. Greene, Fl. Francisc. 441. 1897. TYPE: U.S.A. Arizona: Pima County, "Gravelly plains near Camp Lowell [lectotype label]," 12 Apr. 1881, *C. G. Pringle* (lectotype, selected here, GH; isolectotypes, F, MO, NY, PH, US, VT). —Rydberg (1915: 97) and Ferris (1960: 231) designated the type locality as the Mojave Desert of California. The four collections cited by Gray in the protologue are mounted on one sheet in GH. *E. Palmer 224*, Apr. 1876, "Wickenburg," is from Arizona. Of the remaining collections, only *S. B. Parish & W. F. Parish 1266*, May 1882, "Common on gravelly mesas of the Mojave desert," would initially appear to be from California and thus the lectotype. However, the collection by J. G. Lemmon comprises two plants, each with a number (*100*, *101*) attached to the plants themselves. The label accompanying the Lemmon collection (1880, "Tucson") bears yet another number (*102*). In GH there is a specimen of *E. multicaule* with the number *102* attached to the plant but accompanied by a label (1880, "Mohave Desert + Tucson") bearing the numbers *100* and *101*. Aside from the absence of *E. multicaule* from Arizona, this would appear to be a case of switched labels. One cannot be certain how many of the syntypes cited in the protologue are from California. Therefore, the designation of type locality by Rydberg and Ferris is ambiguous, and Pringle's collection is chosen as lectotype.

Eriophyllum sect. **Antheropeas** (Rydb.) D. E. Johnson, stat. nov. Basionym: *Antheropeas* Rydb., N. Amer. Fl. 34: 97. 1915. TYPE: *E. wallacei* (A. Gray) A. Gray.

Stamen connective tips are subulate in section *Antheropeas*, similar in shape to those of *Syntrichopappus* but narrower and shorter. Other eriophyllums have deltoid connective tips. Style tips of section *Antheropeas* are deltoid with distinctive apical tufts of long papillae.

Eriophyllum lanosum (A. Gray) A. Gray, Proc. Amer. Acad. Arts 19: 25. 1883. *Burrielia lanosa* A. Gray in Torrey, Pacific Railr. Rep. 4(5) [no. 4]: 107. 1857. *Actinolepis lanosa* (A. Gray) A. Gray, Proc. Amer. Acad. Arts 9: 198. 1874. *Antheropeas lanosum* (A. Gray) Rydb., N. Amer. Fl. 34: 98. 1915. TYPE: U.S.A. Arizona: "Gravelly banks near the Colorado of California [holotype label]," 17 Feb. 1854, *J. M. Bigelow* (holotype, GH; probable isotypes, K, NY). —According to Foreman (1941: 223 and map), Bigelow would have been along the Bill Williams River in Mohave or Yuma counties, somewhere between junctions with the Big Sandy and Colorado rivers, on the date of collection.

Antheropeas tenuifolium Rydb., N. Amer. Fl. 34: 99. 1915. TYPE: Mexico. Estado de Baja California: San Sebastián, 28 Apr. 1889, *T. S. Brandegee* (holotype, US; isotypes, NY, PH, UC).

Eriophyllum wallacei (A. Gray) A. Gray, Proc. Amer. Acad. Arts 19: 25. 1883. *Bahia wallacei* A. Gray in Torrey, Pacific Railr. Rep. 4(5) [no. 4]: 105. 1857. *Actinolepis wallacei* (A. Gray) A. Gray, Proc. Amer. Acad. Arts 9: 198. 1874. *Antheropeas wallacei* (A. Gray) Rydb., N. Amer. Fl. 34: 98. 1915. TYPE: U.S.A. California: Los Angeles County, "Teyunga [protologue, i.e., Tujunga]," 7 May 1854, *W. A. Wallace* (holotype, GH; isotype, NY).

Bahia rubella A. Gray in Torrey, Bot. U.S. Mex. Bound., Bot. 2(1): 95. 1859. *Actinolepis wallacei* var. *rubella* (A. Gray) A. Gray, Proc. Amer. Acad. Arts 9: 198. 1874. *Eriophyllum wallacei* var. *rubella* (A. Gray) A. Gray, Proc. Amer. Acad. Arts 19: 25. 1883. *Antheropeas rubellum* (A. Gray) Rydb., N. Amer. Fl. 34: 98. 1915. TYPE: U.S.A. California: San Diego County, "in a dry valley, near San Felipe [protologue]," June 1850, *C. C. Parry* (holotype, GH; isotype, NY).

Eriophyllum aureum T. Brandegee, Bot. Gaz. (Crawfordsville) 27: 449. 1899. TYPE: U.S.A. California: Inyo County, "near Lone Pine—South of Town—Sides of a gulch base of foot hills [holotype label]," 16 Apr. 1891, *T. S. Brandegee* (holotype, UC; isotypes, F, NY, US).

Antheropeas australe Rydb., N. Amer. Fl. 34: 98. 1915. *Eriophyllum wallacei* subsp. *australe* (Rydb.) Wiggins, Contr. Dudley Herb. 3: 304. 1944. TYPE: Mexico. Estado de Baja California: "Mts. [holotype label]," 3 July 1884, *C. R. Orcutt* (holotype, NY; isotypes, BM, F, PENN, UC; probable isotype, NY).

Eriophyllum wallacei var. *calvescens* S. F. Blake, J. Wash. Acad. Sci. 19: 278. 1929. TYPE: U.S.A. California: San Bernardino County, "North of and near Victorville [holotype label]," 11 May 1926, *M. E. Jones* (holotype, US; isotype, LL). —One of the paratypes of this name is the type of *E. aureum*.

Eriophyllum sect. **Pseudomonolopia** (A. Gray) D. E. Johnson, comb. nov. Basionym: *Bahia* Lagasca sect. *Pseudo-monolopia* A. Gray in S. Watson et al., Bot. California 1: 382. 1876. TYPE: *E. ambiguum* (A. Gray) A. Gray. —Article 73.9 of the *Code* (Greuter, 1988) requires elision of the hyphen in this sectional name.

In geographic distribution and morphological aspect, section *Pseudomonolopia* most closely resembles the perennials of section *Eriophyllum*. Unlike those of the other annual sections of *Eriophyllum*, distal portions of limbs of disk corollas are glabrous (except *E. ambiguum* var. *paleaceum*, the lobes of which have unusual papillae). In this character section *Pseudomonolopia* is more similar to *E. lanatum* and its related perennials than it is to other perennials such as *E. confertiflorum* and *E. staechadifolium*.

Eriophyllum ambiguum (A. Gray) A. Gray var. **ambiguum**, Proc. Amer. Acad. Arts 19: 26. 1883. *Lasthenia ambigua* A. Gray, Proc. Amer. Acad. Arts 6: 547. 1865. *Bahia ambigua* (A. Gray) A. Gray in S. Watson et al., Bot. California 1: 382. 1876. TYPE: U.S.A. California: Kern County, "near Fort Tejon [protologue], Fort Tejon [holotype label]," 1864, *G. H. Horn* (holotype, GH; isotypes, UC, US). —The collector's name is written in Gray's hand as "Dr. Van Horn" on the holotype label, but "Dr. G. H. Horn" is printed on the US label, and the latter is the orthography used by Brewer (1880).

Bahia parviflora A. Gray in S. Watson et al., Bot. California 1: 382. 1876. *Eriophyllum parviflorum* (A. Gray) Rydb., N. Amer. Fl. 34: 86. 1915. TYPE: U.S.A. California: Kern County, "Fort Tejon, and vicinity [holotype label]," 1857–1858, *L. J. Xantus* (*de Vesey*) *48* (holotype, GH; isotypes, NY, US).

Eriophyllum ambiguum var. **paleaceum** (T. Brandegee) Ferris, Contr. Dudley Herb. 5: 100. 1958. *E. paleaceum* T. Brandegee, Bot. Gaz. (Crawfordsville) 27: 450. 1899. TYPE: U.S.A. California: Kern County, Kernville, 14 May 1892, *T. S. Brandegee* (lectotype, selected by Rydberg (1915: 87), UC).

Eriophyllum parishii H. M. Hall ex Constance, Madroño 2: 114. 1934, as synonym, name invalid.

Eriophyllum congdonii T. Brandegee, Bot. Gaz. (Crawfordsville) 27: 449. 1899, as "*congdoni*." *E. nubigenum* var. *congdoni* (T. Brandegee) Constance, Univ. Calif. Publ. Bot. 18: 115. 1937. TYPE: U.S.A. California: Mariposa County, "Mountains near Hennessy's [protologue]," 1–5 May 1894, *J. B. Lembert* (holotype, UC; isotype, NY). —Hennessy's residence was at the confluence of Indian Creek and Merced River (Gudde, 1969), a point ca. 1.6 km west of the topographical feature El Portal (U.S. Geol. Surv. 15′ El Portal quadrangle, 1947).

Eriophyllum nubigenum A. Gray, Proc. Amer. Acad. Arts 19: 25. 1883. *Actinolepis nubigena* (A. Gray) E. Greene, Fl. Francisc. 442. 1897. TYPE: U.S.A. California: Mariposa County, "Cloud's Rest (Yosemite) 9000 ft. [holotype label]," July 1883, *K. Curran* (holotype,

GH; isotypes, RSA, VT; possible isotype, DS). —Although in the protologue Gray published the name as "Greene in litt.," in a letter to Greene dated 25 July 1883 (transcription in JEPS) Gray revealed that Greene had forwarded the specimen under a different proposed binomial, "*Actinolepis alpina*," so the published name should be attributed to Gray. The isotypes are much more ample specimens than the holotype, which comprises a few capitula only. The RSA isotype is "ex Gray Herbarium."

Lembertia E. Greene, Fl. Francisc. 441. 1897. TYPE: *L. congdonii* (A. Gray) E. Greene.

Lembertia congdonii (A. Gray) E. Greene, Fl. Francisc. 441. 1897, as "*congdoni.*" *Eatonella congdoni* A. Gray, Proc. Amer. Acad. Arts 19: 20. 1883. TYPE: U.S.A. California: Tulare County, Deer Creek, Mar. 1881, *J. W. Congdon 439* (lectotype, selected by Rydberg (1914: 28), GH).

Monolopia DC., Prodr. 6: 74. 1838. Lectotype, selected by Gray (1876: 383): *M. major* DC.

Spiridanthus Fenzl in Endl., Gen. Pl., Suppl. 2: 105. 1842. —*Spiridanthus* is founded on specimens grown in Vienna from achenes originally thought to come from Africa (protologue: "Africae tropicae"), but this provenance is erroneous (see Bentham, 1873: 400). No combination in *Spiridanthus* was published, but specimens (W) annotated with this name are *Monolopia major*.

Monolopia gracilens A. Gray, Proc. Amer. Acad. Arts 19: 20. 1883. *M. major* var. *gracilens* (A. Gray) J. F. Macbr., Contr. Gray Herb. 56: 49. 1918. TYPE: U.S.A. California: Santa Clara County, "New Almaden [lectotype label]," Apr.–20 July 1865, *J. Torrey 237* (lectotype, selected by Crum (1940: 256), GH). —According to Robbins (1968: 618), Torrey sold his house in April 1865 and then left New York for California, where he was until 20 July, when he arrived in Empire City, Nevada.

Monolopia lanceolata Nutt., Proc. Acad. Nat. Sci. Philadelphia 4: 21. 1848. *M. major* var. *lanceolata* (Nutt.) A. Gray in S. Watson et al., Bot. California 1: 384. 1876. TYPE: U.S.A. California: Los Angeles County, "Pueblo de los Angeles [protologue]," Apr. 1842, *W. Gambel* (holotype not found, BM? (see Stafleu & Cowan, 1981: 781)). —The protologue allows little doubt that the name is correctly applied.

Monolopia major DC., Prodr. 6: 74. 1838. TYPE: U.S.A. California: "1833 [i.e., 22 Dec. 1830–18 Aug. 1832]," *D. Douglas* (holotype, G-DC; probable isotypes, BM, CGE; possible isotypes, GH, K, NY, W). —Although the holotype label bears the date 1833, Douglas "did nothing in the way of Botany" during his stay in San Francisco, 4–29 Nov. 1833 (McKelvey, 1955: 415). He must have made his collection during either of the two springs during his previous visit to California, probably along the mission road between Monterey and Santa Barbara (McKelvey, 1955: 396, 400–405, map facing p. 401). Douglas's collections were distributed by the Horticultural Society of London, by whom, apparently, they were given serial numbers. Whether or not all specimens labeled with the same serial number are from the same gathering is uncertain. Probable isotypes are numbered *25;* possible isotypes are unnumbered.

Hologymne douglasii F. Fischer & C. Meyer, Index Sem. Hort. Bot. Imp. Petrop. 8: 22, 64. 1842. TYPE: "Ex horto bot. Petropolitano [holotype label]," (holotype, LE). —Achenes from which the plants in LE were grown were probably collected by D. Douglas in California, between Monterey and Santa Barbara (see note above, under *Monolopia major*).

Monolopia stricta Crum, Madroño 5: 258. 1940. TYPE: U.S.A. California: Kern County, "Two miles west of Lost Hills [holotype label]," 2 May 1935, *H. L. Mason 9314* (holotype, UC; isotypes, CAS, DS, GH, LL, MO, NO, NY, ORE, PH, POM, RM, US).

Pseudobahia (A. Gray) Rydb., N. Amer. Fl. 34: 83. 1915. *Monolopia* sect. *Pseudo-bahia* A. Gray in S. Watson et al., Bot. California 1: 383. 1876. Lectotype, selected by Rydberg (1915: 83): *P. bahiifolia* (Benth.) Rydb. —This generic name is correct without a hyphen according to Articles 60.1 and 73.9 of the *Code* (Greuter, 1988).

Pseudobahia bahiifolia (Benth.) Rydb., N. Amer. Fl. 34: 83. 1915, as "*bahiaefolia.*" *Monolopia bahiaefolia* Benth., Pl. Hartweg. 317. 1849. *Lasthenia bahiaefolia* (Benth.) A. Gray, Proc. Amer. Acad. Arts 6: 547. 1865. *Eriophyllum bahiaefolium* (Benth.) E. Greene, Fl. Francisc. 446. 1897. TYPE: U.S.A. California: "on pastures of the Upper Sacramento Valley [holotype label], 1848 [i.e., 1–12 Apr. 1847]," *T. Hartweg 208* (holotype, K; iso-

types, BM, CGE, GH, K, NY, W; possible isotype, CGE). —Although the holotype and some isotype labels give the date of collection as 1848, Hartweg collected *208* in 1847 in the vicinity of Cordua's farm (McVaugh, 1970). The property of T. Cordua, "at the junction of the Chuba [i.e., Yuba] with the Feather river [Hartweg, 1848: 219]," is the site of Marysville (Gudde, 1975: 82). Bentham renumbered Hartweg's original *208* as *1788;* the latter number is the only one on some isotype labels.

Pseudobahia heermannii (E. M. Durand) Rydb., N. Amer. Fl. 34: 83. 1915. *Monolopia heermannii* E. M. Durand, J. Acad. Nat. Sci. Philadelphia, ser. 2, 3: 93. 1855. *M. bahiaefolia* var. *pinnatifida* A. Gray in S. Watson et al., Bot. California 1: 383. 1876. *Eriophyllum heermannii* (E. M. Durand) E. Greene, Fl. Francisc. 445. 1897. TYPE: U.S.A. California: Calaveras County, "at Calaveras [protologue]," ca. 1853, *A. L. Heermann* (lectotype, selected by Rydberg (1915: 83), PH; isolectotype, GH). —According to Brewer (1880), Heermann "collected in the central valley of the state in 1853 . . . and perhaps later."

Pseudobahia peirsonii Munz, Aliso 2: 84, 78 (pl. 12, fig. F), 82 (pl. 13, fig. D). 1949. TYPE: U.S.A. California: Tulare County, "grassy flat, Ducor [holotype label]," 20 Mar. 1925, *P. A. Munz 9038* (holotype, POM; isotype, LL).

Syntrichopappus A. Gray in Torrey, Pacific Railr. Rep. 4(5) [no. 4]: 106. 1857. TYPE: *S. fremontii* A. Gray.

Microbahia Cockerell, Muhlenbergia 3: 9. 1907. TYPE: *Syntrichopappus lemmonii* (A. Gray) A. Gray.

Syntrichopappus fremontii A. Gray in Torrey, Pacific Railr. Rep. 4(5) [no. 4]: 106, pl. 15. 1857. TYPE: U.S.A.: "probably in the spring of 1854, and somewhere between the Rocky Mountains and the Sierra Nevada [protologue]," *J. C. Frémont* (holotype, GH; isotype, NY). —According to the protologue, Frémont brought back only a single plant. A fragment annotated by Gray is the holotype, and the much more ample isotype is the model for the plate.

Syntrichopappus lemmonii (A. Gray) A. Gray, Proc. Amer. Acad. Arts 19: 20. 1883, as "*lemmoni.*" *Actinolepis lemmoni* A. Gray, Proc. Amer. Acad. Arts 16: 101. 1880. *Microbahia lemmoni* (A. Gray) Cockerell, Muhlenbergia 3: 9. 1907. TYPE: U.S.A. California: "Mohave Desert, S.E. California, on the borders of Arizona [protologue], 1880 [i.e., 1878?]," *J. G. Lemmon 103* (holotype, GH; possible isotypes, BM, F, MO). —The locality given in the protologue is more than 100 km east of the closest, more precisely located collection site. The holotype label gives the more vague locality, "Mohave Desert," and the source of Gray's supplemental data has not been found. The possible isotypes lack the date of collection, their labels indicating only "N. Sp. in 1880." The date on the label in GH is in Gray's hand, but four additional specimens in CM, F (2), and UC bear the date April 1878 in Lemmon's hand. Of the latter, the one in UC is accompanied by a note in Lemmon's hand, "Mohave desert, near San Bernardino. Ap[r]. '78," which is in the vicinity of other documented collections. There is also a fragment of a letter from Gray to Lemmon with the UC specimen, referring to *103*, perhaps applying to this same gathering. If the date of collection given in the protologue is wrong, as seems likely, the CM, F, and UC collections may also be isotypes.

Excluded Names

Monolopia californica (DC. ex Lindley) F. Fischer & C. Meyer, Index Sem. Hort. Bot. Imp. Petrop. 9: 32, 80. 1843. ≡ *Lasthenia californica* DC. ex Lindley (see Johnson & Ornduff, 1978).

Monolopia glabrata (Lindley) F. Fischer & C. Meyer, Index Sem. Hort. Bot. Imp. Petrop. 9: 32, 80. 1843. ≡ *Lasthenia glabrata* Lindley (see Johnson & Ornduff, 1978).

Monolopia minor DC., Prodr. 6: 74. 1838. *Eriophyllum minus* (DC.) Rydb., N. Amer. Fl. 34: 86. 1915. ≡ *Lasthenia minor* (DC.) Ornd. (see Ornduff, 1966).

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Solanum tepuiense, a New Species of Section *Geminata* (Solanaceae) from the Venezuelan Guayana

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The sandstone plateaus of the Venezuelan Guayana are not areas of great *Solanum* species diversity as they are for so many other groups of flowering plants (Steyermark, 1979). Only three species of the large and diverse section *Geminata* (Knapp, 1986) occur in the region: *Solanum oppositifolium* Ruiz Lopez & Pavón (including *S. puberuloba* Steyerm.), *S. campaniforme* Roemer & Schultes, and the new species described here. These species are separated in the key below.

Members of section *Geminata* are generally small trees and shrubs, an unusual habit in *Solanum*, often growing in primary forest understory. The section is the largest group of nonspiny solanums and comprises some 125 species distributed throughout the Neotropics. Characters useful in recognizing the section are: (1) difoliate sympodial units with geminate leaves or unifoliate sympodial units; (2) leaf-opposed inflorescences; (3) small, white or greenish white flowers; and (4) hard, green fruits at maturity (see Knapp, 1986, for more detailed discussion of the characters of the section).

Solanum tepuiense S. Knapp, sp. nov. TYPE: Venezuela. Bolívar: north-facing slope forest Sororopan, cumbre Sororopán-tepuí, 1,800 m, 15 Dec. 1952, *Maguire & Wurdack 33940* (holotype, NY; isotype, F). Figure 1.

Frutex; *caules* valde alati; *sympodia* difoliata geminata; *folia* elliptica supra glabra nitida subtus pubescentia, trichomatibus uniseriatis pluricellularibus in axillis venarum ferentia; *inflorescentiae* foliis oppositae glabrae; *pedicelli* sub anthesi deflexi; *calycis* lobi late deltoidei, apice tumido; *corolla* alba; *bacca* globosa, in pedicello lignoso deflexo inserta; *semina* ferruginea complanata reniformia, margine incrassato; *testa* foveolata.

Shrub, 2.5 m tall. *Young stems* and leaves with a few yellowish papillae, otherwise glabrous, the branches stout, strongly winged from the decurrent leaf bases. *Bark* of older stems pale green, dull, the wings persisting. *Sympodia* difoliate, geminate. *Leaves* elliptic ("repandly rugose" fide Maguire & Wurdack), thick and coriaceous, somewhat falcate, glabrous and shining adaxially, glabrous or with tufts of simple uniseriate trichomes 0.5–1 mm (5–15 small, beadlike cells) long at the junction of the primary veins and the midrib abaxially, the trichomes arising from the veins, not from the lamina; major leaves 8–14 cm long, 3–5 cm wide, with 7–10 pairs of primary veins, these impressed adaxially, prominent and yellowish abaxially, the apex acute to acuminate, the base acute to attenuate, strongly decurrent onto the stem; petioles winged from the leaf bases, 0.8–2.5 cm long; minor leaves not differing from the majors in shape, 3.5–8 cm long, 1.5–3 cm wide, the apex acute to acuminate, the base acute to attenuate; petioles winged, 0.4–1 cm long. *Inflorescences* opposite the leaves, simple, with a few yellowish papillae at the tips, otherwise glabrous and drying dark brown, 1–1.6 cm long, with 10–14 flowers, only one or two open at a time; *pedicel scars* evenly spaced 1–1.5 mm apart, beginning about ⅓ of the way from the base. *Buds* globose when young, later ellipsoidal, the corolla strongly exserted from the calyx tube just before anthesis. *Pedicels* deflexed at anthesis, glabrous, fleshy, apparently green, strongly tapered toward the base, 1.3–1.7 cm long, ca. 0.5 mm diam. at the base, ca. 2 mm diam. at the apex. *Calyx* tube conical, 1–1.5 mm long, the lobes broadly deltate with an acute apical projection, 0.5–1 mm long, the margins thin and transparent, a few golden papillae at the tips of the lobes. *Corolla* white, somewhat thick and fleshy, 1.5–2 cm diam., lobed nearly to the base, the lobes planar at anthesis (?), minutely papillose at the tips and margins of the lobes. *Stamens* with the anthers 4–5 mm long, 1.5–2 mm wide, poricidal at the tips, the pores ultimately lengthening to slits; free portion of the filaments ca. 0.5 mm long, the filament tube ca. 1 mm long, glabrous. *Ovary* glabrous. *Style* glabrous, 7–8 mm long, expanded apically. *Stigma* bilobed, minutely papillose. *Fruit* a globose berry, green (?) and hard at maturity, ca. 1.5 cm diam.; fruiting pedicels deflexed and woody, 2–2.5 cm long, ca. 1 mm diam. at the base, 2.5 mm diam. at the apex. *Seeds* reddish

Figure 1. *Solanum tepuiense*, habit (from *Maguire & Wurdack 33940*). Inset, abaxial leaf surface, scale bar = 1 mm.

brown, flattened reniform, 4–4.5 mm long, 2.5–3 mm wide, the margins incrassate and paler, the surfaces minutely pitted.

Habitat and distribution. *Solanum tepuiense* is known only from the type collection from the top of Sororopán-tepuí, a low-elevation sandstone table mountain near the Gran Sabana region (Fig. 2). The plant apparently grows in forest.

Solanum tepuiense is related to *S. nudum* Dunal, a widespread species of Central and northern South America (see Knapp, 1986). It differs from *S. nudum* in its larger flowers and strongly winged stems. The internodes in the type collection are very short and are perhaps a distinctive feature of *S. tepuiense*, but this may instead be related to habitat and thus not consistent. The trichomes of *S. tepuiense* are quite different from those of *S. nudum* in being composed of many small cells. The cells appear beadlike and are generally square in shape (Fig. 1). The trichomes of *S. nudum* are composed of two or three elongate cells and are often branched.

Solanum tepuiense is not easily confused with any other *Solanum* occurring in the Guayana region. The following key will distinguish it from the other members of section *Geminata* in the Venezuelan Guayana.

1a. Leaves glabrous and drying golden abaxially; inflorescence axis covered with minute, golden, erect trichomes ..... *Solanum oppositifolium*

1b. Leaves with tufts of trichomes at the junctions of the primary veins and the midrib abaxially, if glabrous not drying golden; inflorescence axis glabrous.

2a. Stems winged, the bark light green; leaves repandly rugose, somewhat fleshy, drying olive green; inflorescence axes 1–1.6 cm long, somewhat fleshy ... *Solanum tepuiense*

2b. Stems not winged, the bark dark reddish brown, peeling on older stems; leaves dark green and brittle in live plants, drying black; inflorescence axes 5–16 cm long, not fleshy ..... *Solanum campaniforme*

Figure 2. Distribution of *Solanum tepuiense*.

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The Relationships of *Solanum cochoae* (Solanaceae), a New Species from Peru

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The genus *Solanum*, with nearly 3,500 epithets, is second only to *Senecio* in size, and its species are notoriously variable (Correll, 1962). Growing appreciation for intraspecific variation has helped make recognition of species boundaries more realistic to the point that only about one-half of the species that have been described are now accepted (D'Arcy, 1979). This daunting diversity and variability gives one pause in describing a new species. Thus, we have grown and studied the subject of this paper for some time; we are now convinced it deserves recognition as a distinct species. The diagnosis and description of this new species follows the discussion of its systematic uniqueness and relationship.

Morphological Features

Like many species of *Solanum*, or at least species in subg. *Potatoe*, *S. cochoae* is morphologically distinct, but this distinction is based on a combination of characters, no one of which is unique to *S. cochoae*. This means that taxa may be characterized by a combination of nonunique characters (homoplasious features).

The species from *Solanum* sect. *Basarthrum* (Bitter) Bitter that are morphologically similar to *S. cochoae* are given in Table 1, with the characters that distinguish each from *S. cochoae* marked with an asterisk. As is clear from these data, *S. cochoae* can be readily distinguished from its most similar relatives. It is a member of series *Caripensia* Bitter & Sodiro and is most like the following species: *S. caripense* Humb. & Bonpl. ex Dunal, *S. tabanoense* Correll, *S. basendopogon* Bitter, *S. trachycarpum* Bitter & Sodiro, *S. filiforme* Ruiz Lopez & Pavón, *S. fraxinifolium* Dunal in DC, and *S. heiseri* G. J. Anderson. The last three are sibling species of *S. caripense* and are represented in Table 1 by *S. caripense*. Five other species are included in Table 1 because they are morphologically similar to *S. cochoae*. *Solanum muricatum* Aiton, *S. suaveolens* Kunth & Boché, and *S. canense* Rydb. are also from series *Caripensia*. The other two species, *S. taeniotrichum* Correll and *S. sanctae-marthae* Bitter, are superficially confusable with *S. cochoae*, but are probably not closely related (Anderson et al., 1987). *Solanum cochoae* is characterized within series *Caripensia* as the only species with compound leaves and with a branched inflorescence bearing an average of more than 20 flowers (Fig. 1). Within section *Basarthrum* as presently circumscribed, it is the only species with these characters (Table 1) and with two-celled "bayonet" hairs (Seithe & Anderson, 1982) (see Fig. 1). In addition to these quantitative differences, *S. cochoae* is distinguished from the *S. caripense* complex by such qualitative differences as the generally pale yellow/white anthers (vs. orange-yellow) and the more compact, headlike inflorescence (vs. elongate raceme).

Crossing Studies

Intraspecific crosses (see Table 2) confirm that this species is, like the vast majority of others in section *Basarthrum* (Anderson, 1979), self-incompatible: none of more than 150 intraplant ("self") crosses were successful. On the other hand, almost one-half of the interplant crosses were successful, and the resulting seeds germinated readily to produce highly fertile plants (pollen fertility $\bar{x}$ value = 98%, "fertility" assayed by staining with aniline blue in lactophenol). The degree by which the style exceeds the staminal column ($\bar{x}$ = 1.7 mm, Table 1) is very close to the average ($\bar{x}$ = 1.9) for the self-incompatible (outcrossing) species previously recognized for section *Basarthrum* (Anderson, 1979) and thus adds support for this generalization in *Solanum*.

More than 900 crosses were attempted between *S. cochoae* and its seven morphologically most similar, related wild species (Table 2). A good percentage of these resulted in fruit, but virtually all produced fruits with very few seeds, and none of the seeds germinated. Thus, no crosses with any related wild species were successful.

Crosses were also attempted with the cultivated domesticate, *S. muricatum* ("pepino dulce"). About 10% of these crosses were successful regardless of

TABLE 1. Distribution and characters of morphologically similar species. Characters distinguishing each species from *Solanum cochoae* are marked with an asterisk (*). All measurements and means are in millimeters. Species codes are as follows: COCH = *Solanum cochoae*; CARI = *S. caripense*; TABA = *S. tabanoense*; BASE = *S. basendopogon*; TRAC = *S. trachycarpum*; MURI = *S. muricatum*; SUAV = *S. suaveolens*; CANE = *S. canense*; TAEN = *S. taeniotrichum*; and SANC = *S. sanctae-marthae*.

	Species codes									
	COCH	CARI	TABA	BASE	TRAC	MURI	SUAV	CANE	TAEN	SANC
Distribution	Peru	Central & South America	South America	Peru	Ecuador	South America	South America (Central America)	Central America (South America)	Costa Rica	Colombia
Fruit color	green	green, purple stripes	green, purple stripes	green	green	green, cream,* purple*	green	green	red*	green
Fruit surface	smooth	smooth	smooth	warty*	verrucose*	smooth	smooth	smooth	smooth	smooth
Habit	viny bush	viny bush	viny bush	small shrub*	small shrub*	small shrub*	lax herb*	lax herb*	viny bush	viny bush
Hair types	bayonet	bayonet	bayonet	bayonet	bayonet	bayonet	bayonet	bayonet	finger*	finger*
Inflorescense axes	2	1*	1*	3.2*	1*	1–3	1.1*	2	4*	2
Flowers/inflorescense	26.7	10.9*	10.5*	19*	2.1*	9.7*	9.5*	17.0*	42*	19*
Corolla lobe length	8.4	8.3	9.6	7.6	7.4	10.7	6.1	6.2	15.5*	10.8
Corolla lobe/sinus	1.6	1.7	4.0*	1.5	1.7	1.9	1.4	2.5*	1.4	1.6
Anther length	3.5	3.8	5.4	4.0	2.6	3.7	3.0	2.9	4.3	5.6*
Style length	5.7	5.9	7.1	6.9	4.1	6.3	3.2*	3.8	7.0	7.0
Style past anthers	1.7	1.9	2.2	2.1	0.7*	2.6	0.1*	0.7*	—	—

TABLE 1. Continued.

	Species codes									
	COCH	CARI	TABA	BASE	TRAC	MURI	SUAV	CANE	TAEN	SANC
Leaflets	4.3	4.8	1.2*	1*	1*	1–7	9.6*	10.9*	5	3–7
Terminal leaflet length	44.6	33.5	52.3	34.8	33.1	72.5*	47.3	48.8	66.7*	76*
Terminal leaflet length/ width index	1.66	1.74	2.9*	1.85	1.89	0.83*	3.9*	3.2*	2.8*	2.4

Figure 1. *Solanum cochoae.* —A. Branch of plant showing compound leaves and branched inflorescence. —B. Representative two-celled bayonet hairs. —C. Flower with moderately reflexed corolla and style exceeding staminal column. —D. Androecium and gynoecium with short hairs on adaxial face of filaments and over lower 75% of style. Scale bars = 1 mm.

the direction of the cross (Table 2). Few seeds were set, few of these germinated, but the resulting F_1 hybrids had surprisingly high pollen fertility ($\bar{x}$ = 86%, n = 18).

Solanum cochoae appears to be isolated by breeding barriers from the wild species that are morphologically and/or geographically closely allied to it. The relative crossing success with *S. muricatum* is of interest, because *S. cochoae* now must be considered along with *S. basendopogon*, *S. caripense*, and *S. tabanoense* (Anderson et al., 1987; Heiser, 1985) as one of the possible progenitors of this exclusively domesticated species.

Chromosome Morphology

Publication of detailed analyses of the karyotypes of species of section *Basarthrum* included this new species as "934" (Bernardello & Anderson, 1990). Karyotypically *S. cochoae* is, as might be predicted, most similar to the other wild species in series *Caripensia* and to *S. muricatum*. The karyotype for *S. cochoae* consists of the following chromosomes: five metacentrics, six sub-metacentrics, and one subterminal. Four other species have a subterminal chromosome: *S. muricatum*, *S. fraxinifolium*, *S. canense*, and *S. suaveolens*. The last three have

significantly smaller chromosomes overall than *S. cochoae*. The genome of *S. muricatum* is different from that of *S. cochoae* in a number of ways: two of the more significant are that *S. muricatum* bears a telocentric, and eight chromosomes have different arm ratios and are longer.

Overall genome homology of *S. cochoae* and *S. muricatum* is implied as well by the high fertility of F_1 hybrids between them. The "cochoae" genome apparently even acts as a "fertility restorer": F_1 hybrids have almost twice the pollen fertility ($\bar{x}$ = 86%) of the "muricatum" parent ($\bar{x}$ = 47%).

Flavonoids

Solanum cochoae, as "934," was characterized by six of the 11 flavonols recognized for section *Basarthrum* (Anderson et al., 1987). There are no unique compounds delineating *S. cochoae*. The species with most similarity (based on a Manhatten Distance estimate) to *S. cochoae* are those from series *Caripensia* (*S. tabanoense* 17%, *S. filiforme* 33%, *S. trachycarpum* 44%, *S. muricatum* 50%, *S. basendopogon* 56%, *S. suaveolens* 57%, *S. caripense* 60%, *S. fraxinifolium* 62%, *S. heiseri* 62%, *S. canense* 67%). However, there are several other species in the section associated with *S. cochoae* at close to the 40% level, so these values do not constitute a strong argument for the exclusive membership of *S. cochoae* in series *Caripensia*, or alternatively, for using flavonoids as characters verifying the cohesiveness of this series.

Discussion

The successful crosses with the pepino dulce (*S. muricatum*) are of special interest. *Solanum cochoae* now becomes one of only four species that has been crossed successfully with the pepino dulce (Anderson, 1979; Heiser, 1985). The relatively high fertility of the F_1 hybrids between these two species may indicate a place for *S. cochoae* in the ancestry of the pepino dulce, an issue of interest not only in determination of the origin of this cultigen, but potentially for its improvement through breeding as well. The F_1 hybrids are also of interest because they are self-compatible. The pepino dulce accessions used were all self-compatible, and the *S. cochoae* accession is self-incompatible. Thus, the self-compatibility of the F_1s seems to document the dominance of genes or alleles for this breeding system character state at least in this section of *Solanum*.

By virtue of the articulation of the pedicels at their base, lack of tubers (Correll, 1962), and two-celled bayonet hairs (Seithe & Anderson, 1982), *S. cochoae* is best placed in *Solanum* sect. *Basarthrum*. Within the section, *S. cochoae* is very similar to the widespread and highly variable *S. caripense* and sibling species (see above). In spite of its overall similarity to members of the *S. caripense* complex, clearly *S. cochoae* constitutes a distinct species. Morphologically, cytologically, and chemically, it bears distinguishing features. These coupled with the virtual lack of production of viable hybrids in close to 1,000 crosses with its closest wild relatives argue strongly for its unitary evolutionary role.

Table 2. Crossing studies among *Solanum cochoae* and its relatives. Codes are: F = very few hybrid seeds produced; H = high germination of hybrid seeds; L = low germination of hybrid seeds; N = no germination of hybrid seeds; Ph = F_1 pollen fertility high. Fractions in parentheses give the number of crosses successful over the number attempted.

	Intraplant	Interplant
	0% (0/165)	42% (53/126) H, Ph
Solanum cochoae	*S. cochoae* as: Female parent	Male parent
S. muricatum (cultivated)	8% (8/96) F, L, Ph	12% (19/163) F, L, Ph
S. basendopogon	2% (2/124) F, N	0% (0/120)
S. caripense	2% (3/146) F, N	65% (43/66) F, N
S. filiforme	8% (1/12) F, N	—
S. fraxinifolium	0% (0/82)	39% (12/31) F, N
S. heiseri	0% (0/50)	0% (0/17)
S. tabanoense	0% (0/2)	0% (0/19)
S. trachycarpum	0% (0/14)	0% (0/22)

Key to the species of *Solanum* section *Basarthrum* series *Caripensia*

1a. Leaves primarily simple.
  2a. Inflorescence branched .... *S. basendopogon*
  2b. Inflorescence not branched.
    3a. Corolla rotate ..... *S. trachycarpum*
    3b. Corolla stellate ..... *S. tabanoense*
1b. Leaves primarily pinnately compound.
  4a. Inflorescence branched.
    5a. Viny bush, fruits smooth surfaced, flowers usually about 20–25 per inflorescence ..... *S. cochoae*
    5b. Upright subshrub, fruits verrucose or

warty, flowers usually 20 or less per inflorescence ..... *S. basendopogon*

4b. Inflorescence simple .... *S. caripense* complex (including *S. caripense*, *S. filiforme*, *S. fraxinifolium*, and *S. heiseri*)

Solanum cochoae G. J. Anderson & Bernardello, sp. nov. TYPE: Peru. Amazonas: Prov. Chachapoyas, Dist. Maino, Convent, alt. 2,800 m, 31 Mar. 1979, *C. Ochoa 13249* (holotype, US; isotypes, F not seen, GH not seen, WI not seen). Figure 1.

Plantae suffrutex; folia in foliola 3–5 divisa; indumentum duo cellulis pugioti pili; inflorescentia furcatus plerumque cum 20–30 floribus; pedicelli basaliter articulati.

Viny or trailing shrub, branches up to 1 m long, internodes 20–80 cm, with moderately dense, strigose vesture of two-celled bayonet hairs throughout and scattered short gland-tipped hairs, stem woody or thick-herbaceous, older branches occasionally rooting at the nodes; leaves with 3–5 leaflets, 80–100 mm long (holotype 149 mm), with petiole 18–30 mm long (holotype 49 mm); leaflets lanceolate to lanceolate-elliptic, base obtuse to truncate, apex acute to acuminate, with moderately dense, strigose vesture of two-celled bayonet hairs, glandular hairs sparse on both surfaces; terminal leaflet somewhat larger than the first pair of lateral leaflets, 36–55 mm long (holotype 68 mm), 19–31 mm wide; first pair of lateral leaflets 30–40 mm long (holotype 49 mm), 9–20 mm wide, short petiolulate; pseudostipules lacking; inflorescence a pseudoterminal and/or lateral raceme with 2 (rarely 3) axes and 15–61 flowers; pedicels 6–11 mm long, basally articulate, densely strigose vesture of two-celled bayonet hairs intermixed with short gland-tipped hairs; corolla white, rotate, moderately reflexed, lobes 5.5–9.5 mm long, sinuses 4–6 mm long, lobe/sinus ratio about 1.6, glabrous adaxially, sparsely strigose to hispid abaxially; calyx green, acute to acuminate, about ¼–⅓ the length of the corolla lobes, strigose vesture moderate to heavy; anthers pale yellow, apices rounded, 2.2–3.8 mm long, glabrous abaxially, a few scattered stiff hairs adaxially; filaments 1.5–2.7 mm long (holotype 0.7 mm), fused for less than ¼ of their length, scattered stiff hairs along their margin; style 3.9–6.5 mm long, sparingly strigose over lower ¾ of its length, hairs intermeshing with those of the anthers, stigma slightly capitate, exceeding staminal column by 1–2 mm; fruits globose to elliptic-ovoid, mature fruits yellow-orange with darker orange-brown arms from pedicel to style scar, 20–30 mm long and 13–18 mm wide, surface smooth; seeds 60–200 per fruit, lenticular, flattened with narrow wing around margin of seed, 1.9–2.2 mm long by 1.4–2.0 mm wide, about 0.4–0.7 mm thick, brown, surface smooth to slightly rugose; pollen tricolporate, 15–18 μm diam., exine granular; mean pollen quantity 332,000 grains per flower; mean ovule quantity 146 per flower; mean pollen: ovule ratio 2315:1; $n = 12$. (See Table 1 for some average characters.)

Phenology and distribution. The only collection of this species to date, from near Chachapoyas, Peru, was in flower. Glasshouse-cultivated specimens flower year-round.

We have also studied an isotype from Carlos Ochoa's personal herbarium. Correspondence with the herbaria cited as housing the isotypes failed to yield the specimens. Thus, the bulk of the study was focused on a large number of plants grown from seed of the type collection. Specimens cultivated (GJA #934) in glasshouses at the University of Connecticut as part of this study have been deposited in CONN, CORD, MO, WI, and US.

This species is named in honor of Carlos Ochoa, who collected it and has made many important contributions to the systematics of *Solanum* through his fieldwork and writing.

In correspondence, Ochoa gave the following additional collection information ". . . near Maino, some 15 km (air distance) southeast of Chachapoyas, 2600–2800 m alt. . . . Plants of more than 1 m in height with long-conic berries, 2–3 cm long and 1.5–1.8 cm in the maximum transversal diam., yellow when ripe, edible according to local information. Vernacular name: *Pepinillo*."

Ochoa also noted that the plant collected was growing in association with *Bidens andicola*, *Oyedaea buphthalmoides*, *Desmodium mollicolum*, *Cassia* sp., *Triunfetta calycina*, *Axonopus scoparius*, *Cyperus hermaphroditus*, *Solanum furcatum*, *Crotalaria nutans*, and *Lupinus allworthianus*.

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The Monotypic Malagasy Genus *Alleizettea* is *Danais volubilis* (Rubiaceae)

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During an investigation of *Danais* currently underway and carried out primarily in order to obtain further evidence for the subfamilial and tribal position of the genus (subfam. Cinchonoideae tribe Cinchoneae or subfam. Rubioideae tribe Hedyotideae; cf. Robbrecht, 1988), herbarium (P) material was studied, and the holotype specimen of *Alleizettea bracteata* Dubard & Dop, the only species of this Malagasy genus, surfaced.

The specimen, which unfortunately had never been marked as a type, was apparently placed with undetermined material of *Danais* after someone had detected its resemblance to species of that genus.

Dubard & Dop (1925) suggested in the protologue that *Alleizettea* belongs to the tribe Mussaendeae (now Isertieae), the presence of raphides in the tissues of *A. bracteata* being a good argument in favor of its placement in that tribe. Listing several differences, they argued that there is no close alliance between *Alleizettea* and Malagasy species of *Mussaenda* and suggested that it is closer to *Sabicea* (also Isertieae) and to *Urophyllum* (= *Pauridiantha*, Pauridiantheae).

In his survey of the Rubiaceae, Robbrecht (1988) did not follow Dubard & Dop and listed *Alleizettea* among the dubious genera (p. 196). He was probably led to this decision by Dubard & Dop's outdated conception of the Mussaendeae. Most of the genera they considered belonging to that tribe have since been placed elsewhere, and the Isertieae, as circumscribed presently, are characterized by the absence of raphides.

Moreover, it was found upon reexamination of the type that Dubard & Dop's protologue is misleading and inadequate in some aspects. There is, for example, no reference to the characteristic winged seeds, although almost mature fruits were available, and they had discovered, when closely studying the ovaries, that the placentas bear numerous ovules that are flattened at the margins, i.e., having wing-like projections of the ovules that are seen even before fertilization and increase in size afterwards.

Danais Vent., Tabl. 2: 548. 1799.

Alleizettea Dubard & Dop, J. Bot. (Morot) sér. 2, 3: 6 (1925), syn. nov. TYPE: *A. bracteata* Dubard & Dop.

Danais volubilis Baker, J. Linn. Soc., Bot. 20: 161. 1883. TYPE: Madagascar. Top of Ifody mountain, *Baron 1372* (holotype, BM; isotypes, K, P).

Alleizettea bracteata Dubard & Dop, J. Bot. (Morot) sér. 2, 3: 6, fig. 3. 1925. syn. nov. TYPE: Madagascar. Betsitra par Anjozorobé (Imerina du Nord), *d'Alleizette 1* (holotype, P).

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New Species and Combinations in Mexican and Central American *Rondeletia* (Rubiaceae)

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Rondeletia L. (Rubiaceae, Cinchonoideae) in the broad sense is a tropical American genus comprising approximately 125 species of shrubs and small trees (Mabberley, 1987; Willis, 1988) ranging from Mexico through Central America into South America and the West Indies. While revising the genus for *Flora Mesoamericana* and *Flora of Chiapas*, 11 new species came to light and are herein described and illustrated. In addition, two new names are proposed.

First described by Plumier (1703), *Rondeletia* was named for the French physician Gulliaume Rondelet. The name was later validated by Linnaeus (1753). *Rondeletia americana*, one of Linnaeus's two original species, has been designated as the lectotype species (Hitchcock, 1929: 131.). Planchon (1849) subdivided *Rondeletia* into three genera: *Rondeletia; Rogiera*, segregated from *Rondeletia* on the basis of its pentamerous flowers and corollas with an externally glabrous tube and bearded throat with yellow or sometimes white hairs; and *Arachnothryx*, separated on account of its cobwebby pubescence, tetramerous flowers, and corollas with a naked throat. *Rondeletia* thus included only those species with pentamerous flowers having a fleshy faucial ring (Planchon, 1849). Hooker (1873) and Hemsley (1879, 1881) accepted *Rondeletia* in the broad sense, recognizing *Arachnothryx* and *Rogiera* as sections.

In his treatment of Rubiaceae for *North American Flora*, Standley (1918) subdivided *Rondeletia* sens. lat. into 15 species groups, but these named groups were given without rank. Four occur in both Mexico and Central America (*Amoenae*, *Laniflorae*, *Leucophyllae*, and *Calycosae*), two additional ones occur in Central America (*Hondurenses*, with a single species in Honduras, and *Odoratae*, which is centered in the West Indies), whereas the remainder are restricted to the West Indies. Standley's *Amoenae* consists of those species with pentamerous flowers having a bearded corolla throat and is thus equivalent to *Rogiera*. *Calycosae*, *Laniflorae*, and *Leucophyllae* have tetramerous flowers with a naked throat and clearly pertain to the *Arachnothryx* alliance; Standley defined these groups on the basis of pubescence and inflorescence structure. They are poorly differentiated, however, as the distinguishing characters intergrade, particularly when the species included in this paper are considered. *Hondurenses* is closely related to the latter three sections, differing primarily in having large pentamerous flowers. *Odoratae* has pentamerous flowers with a fleshy faucial ring and thus belongs in *Rondeletia* sens. str. Two species in *Odoratae* have been recorded from Panama: *R. panamensis* DC. and *R. odorata* Jacq. The latter is otherwise confined to Cuba but is widely cultivated. Its presence in Panama is likely based on cultivated material. In view of the available evidence, I believe that *Arachnothryx*, *Rogiera*, and *Rondeletia* (excluding the West Indian species, which I have not critically studied) are best treated as segregates of *Rondeletia*, probably at the level of subgenera. More detailed discussion is given below.

In most modern floristic treatments (e.g., Dwyer, 1980; Kirkbride, 1969; Standley & Williams, 1975) *Arachnothryx* and *Rogiera* have been considered as synonyms of *Rondeletia*. Kirkbride (1969) noted that capsule dehiscence and seed morphology did not consistently separate Panamanian *Arachnothryx* and *Rondeletia* species. *Arachnothryx* was recognized at the generic level by Steyermark (1967, 1974) in his treatments of Rubiaceae of the Guyana Highlands and Venezuela. He segregated *Arachnothryx* from *Rondeletia* using a combination of characters involving capsule dehiscence, pubescence type, and seed, flower, and stipule morphology. Unfortunately, Steyermark did not consider in his study any *Rondeletia* species (including *Arachnothryx* and *Rogiera*) from Mexico, Central America, and the West Indies, areas that are important centers of diversity for the group.

Borhidi and his collaborators proposed a very narrow generic concept for *Rondeletia*, limiting its scope to include about a hundred West Indian species (Borhidi, 1982, 1987; Borhidi & Fernandez Zequeira, 1981, 1982, 1983; Borhidi & Járai-Komlódi, 1983). They consequently resurrected *Arachnothryx* and *Rogiera* and described three new genera to accommodate certain species from the West

Indies and one from Honduras. Borhidi & Fernandez Zequeira (1981, 1982, 1983) described two segregate genera, *Roigella* Borhidi & Fernandez from Cuba (one species), and *Suberanthus* Borhidi & Fernandez from Cuba and Hispaniola (nine species). Because these two genera are restricted to the West Indies, they are outside the scope of the present treatment and will not be discussed further.

The monotypic genus *Javorkaea* was described by Borhidi & Járai-Komlódi (1983) to encompass *Rondeletia hondurensis* J. D. Sm., a species endemic to Honduras and recognized by Standley (1918) as comprising his monospecific group *Hondurenses*. According to Borhidi & Járai-Komlódi (1983), *Javorkaea* ". . . differs from both *Rondeletia*, *Rogiera* and *Arachnothryx* in having a broad, connate stipular ring with 1–3-lobed stipules, a 2–3-storied racemelike terminal-cymose inflorescence, a 5–7-parted zygomorphic calyx, with long tube above the hypanthium, the large corolla with bearded lobes at the base, the granulated style and the headlike conduplicate stigma and the 4-colporate, punctitegillate pollen grains." However, their study and description of *Javorkaea* was based on a single specimen, which is not even the type collection of *Rondeletia hondurensis*. Examination of approximately 25 collections of this species revealed the range of morphological variation to be substantially greater than that noted by Borhidi & Járai-Komlódi (1983). For example, I observed flowers with 4- as well as 5–7-merous calyces, and inflorescences that are generally compactly corymbiform, not distinctly 2–3-storied as they characterized it.

In the same series of papers, Borhidi (1982, 1987) resurrected *Arachnothryx* and *Rogiera*, into which he transferred the majority of Mexican and Central and South American *Rondeletia* species. Under *Arachnothryx*, Borhidi (1982) recognized three sections (*Arachnothryx*, *Laniflorae*, and *Calycosae*) based on Standley's species groups, but he failed to typify them. In the latter paper (Borhidi, 1987), the species he transferred to *Arachnothryx* were not even assigned to sections. The generic delimitations of Borhidi and collaborators are based primarily on the structure of the corolla throat (i.e., the presence or absence of pubescence or a fleshy faucial ring or callosity), pubescence of the corolla tube, placental structure (sulcate or not), and pollen morphology. However, pollen morphology fails to provide convincing evidence for generic segregation. Pollen was said to be "3-colporate" in *Arachnothryx*, *Rogiera*, and *Rondeletia* (Borhidi, 1982) and "4-colporate" in *Javorkaea*, but it is unclear how many species were surveyed in his study. Only two photos depicting a single species each of *Arachnothryx* and *Rogiera* were published by Borhidi (1982), and these do not differ substantially in morphology.

Although cytological information was not mentioned by Borhidi, counts have been published for six species in this group (Kiehn, 1986). Diploid chromosome numbers of $2n = 34–36$ have been reported for two species of *Arachnothryx* (indicating a base number of $x = 9$), as opposed to $2n =$ ca. 40 and $2n = 44$ for four species encompassing *Rogiera* and *Rondeletia* sens. str. (indicating base numbers of $x = 10$ and $x = 11$) (Kiehn, 1986, in press). These data are preliminary, and further cytological information may help circumscribe generic boundaries in this complex.

While studying the Mexican and Central American *Rondeletia* for treatments for *Flora Mesoamericana*, *Flora of Chiapas*, and *Flora de Veracruz* (Lorence, in prep.), I encountered species with virtually every possible combination of morphological characters used to separate *Arachnothryx*, *Rogiera*, and *Rondeletia* sens. str. For example, *Rondeletia galeottii* Standl. possesses fusiform seeds winged at both ends, a key character of *Rondeletia* sens. str., but has reflexed foliaceous stipules diagnostic of *Rogiera*, and tetramerous corollas with a naked throat lacking a fleshy ring, features that would otherwise place it in *Arachnothryx*. On the other hand, *Rondeletia izabalensis* Standl. & Steyerm., a species closely related to *R. galeottii*, has unwinged seeds. *Rondeletia strigosa* (Benth.) Hemsl. has a fleshy ring and yellow pubescence in the throat, in effect linking *Rogiera* and *Rondeletia*. Septicidal versus loculicidal capsule dehiscence, used by Steyermark (1967) to separate *Arachnothryx* from *Rondeletia*, is not a constant feature. In many Mexican and Central American species, dehiscence is initially loculicidal, then septicidal. In addition, *Rondeletia secunda* Standl. from Panama matches *Arachnothryx* in all features except its loculicidally dehiscent capsules (Kirkbride, 1969). Finally, *Rondeletia brandegeeana* (discussed below) combines a number of floral and fruit features of *Arachnothryx*, *Javorkaea*, *Rogiera*, and *Rondeletia*, in effect linking them.

I believe the majority of characters used to differentiate *Javorkaea* from *Rondeletia* are of minor importance (i.e., the relatively long stipular sheath and calyx cup, 1–3 stipule lobes, zygomorphic calyx, large corolla with basally barbate lobes within, and oblong ovary and capsule). Most of these features occur in various combinations in one or more species of *Rondeletia* (including *Rogiera* and *Arachno-*

thryx) and merely represent extremes in a continuum of variation. Although the subcapitate, bilobed stigma and 4-colporate pollen grains appear to be distinctive for this species at the sectional level, as proposed by Standley (1918), they do not provide sufficient bases for recognition at the generic level, in my opinion.

Because of the existence of intermediate taxa linking these four genera and lack of a firm basis from detailed analyses, I believe, at present, it is unfeasible to recognize *Arachnothryx*, *Rogiera*, and *Javorkaea* as genera distinct from *Rondeletia*. A similar conclusion was reached over a century ago by Hemsley (1879), who stated that the distinctions between *Arachnothryx*, *Rogiera*, and *Rondeletia* ". . . break down and become intermixed with a large number of species, so it becomes necessary to reunite them or increase the number [of genera] by two or three; and I think the former course preferable." In order to circumscribe critically generic boundaries for *Rondeletia* and allied genera, additional studies analyzing the cytology, palynology, morphology and anatomy, and breeding systems of the entire range of species are required, a task that is outside the scope of this study. I therefore decided to follow Kirkbride (1969), Standley & Williams (1975), Dwyer (1980), and Lorence & Castillo-Campos (1988) in recognizing the Mexican and Central American species as belonging to *Rondeletia* in the broad sense, encompassing *Arachnothryx*, *Javorkaea*, and *Rogiera*. Based on the available evidence, these segregates are probably best recognized as subgenera of *Rondeletia*.

As interpreted here, *Rondeletia* is one of the largest genera of Rubiaceae in tropical America, with approximately 55 species in Mexico (Lorence, 1990). Some 76 species occur in the Mesoamerican region, of which about 40 are shared with Mexico. *Rondeletia* is a primarily tropical genus that attains its greatest diversity in the montane mesophytic and cloud forest communities, where it reaches about 20–23°N latitude in the Sierra Madre Oriental of Veracruz and the Sierra Madre Occidental of western Mexico in Sinaloa. A few species also occur in lowland tropical rainforest (Lorence & Castillo-Campos, 1988) and semideciduous dry forest communities. Recent botanical exploration and collecting efforts in poorly known or unexplored regions of Mexico and Central America, and study of herbarium specimens for the preparation of accounts for *Flora of Chiapas* and *Flora Mesoamericana* have brought to light 11 new species of *Rondeletia*, which are described below. In addition, two new combinations and names are proposed. A key to the Mesoamerican species will be given in the forthcoming treatment of Rubiaceae in *Flora Mesoamericana*, and a key to the Mexican species will be published separately.

1. Rondeletia atravesadensis Lorence, sp. nov.
TYPE: Mexico. Oaxaca: Cerro Atravesada–Cerro Azul, Arroyo "Rana," 6 Dec. 1956, *T. MacDougall s.n.* (holotype, MEXU, photo PTBG). Figure 1A, B.

Species *Rondeletiae guerrerensis* Lorence affinis, foliis minoribus 2–4 cm longis 1.2–2.4 cm latis, inflorescentia breviori 3–4 cm longa, floribus 7–13, lobis calycinis anguste triangularibus vel subulatis 0.2–0.7 mm latis, corolla lobis minoribus 1.5–2.5 mm longis, 1.5–2 mm latis differt.

Shrubs or small trees, the young twigs strigillose, the trichomes pale brown or fulvous, simple, acicular, to 0.6 mm long, the twigs terete, 0.7–1.5 mm diam., glabrate, longitudinally fissured, the internodes 1.5–3 cm long. Leaves opposite, those of a pair at a node subequal or unequal, petiolate; petioles 4–9 mm long, 0.5–0.6 mm diam., densely strigillose; lamina ovate, 2–4 × 1.2–2.4 cm, thickly chartaceous, drying dark brownish green, discolorous, adaxially dull, strigillose on the costa, sparsely so on the 2° veins and margin, abaxially strigillose on the costa and 2° veins, the base obtuse or rounded, the apex acuminate, the acumen 6–12 mm long, the 2° veins (3–)4 pairs, barbate in the axils abaxially, acrodromous, the venation visible to 3° adaxially and to 4° abaxially, the margin ciliolate; stipules deltoid, 2 mm long, erect, externally strigillose. Inflorescence terminal, 3–4 cm long and wide including the corollas, cymose, 7–13-flowered, the peduncle 4–12 mm long, 1 mm diam., densely hirsutulous, trichotomous, the 3 primary branches 6–16 mm long, 0.5 mm diam., villous, subtended by a pair of narrowly ovate bracts 4–5 mm long or by reduced leaves, each branch terminating in a cymule of (1–)3(–7) flowers; flowers 4-merous, subsessile or on villous pedicels to 1.5 mm long, usually subtended by a linear bracteole 1–2 mm long, the hypanthium densely fulvous villous, turbinate, 1.5 × 1 mm, the calyx cup 0.3 mm deep, internally glabrous, the calyx lobes erect-spreading, subequal or unequal, narrowly triangular or subulate, 2.5–5 × 0.2–0.7 mm, externally villous, internally glabrous, each sinus with 2 small colleters; corolla white when fresh, at anthesis salverform, the tube 12–14 mm long, externally strigillose-villous, the trichomes white, internally sparsely hirtellous in basal ⅓–½, the lobes spreading, broadly elliptic or semicircular, 1.5–2.5 × 1.5–2 mm, externally strigillose basally,

Figure 1. —A, B. *Rondeletia atravesadensis* Lorence. *MacDougall s.n.* in 6 Dec. 1956 (holotype, MEXU).

internally glabrous, the margin undulate, the throat glabrous; stamens 4, in short-styled flowers the tips exserted for 0.5 mm, anthers attached 1 mm below throat, sessile, 1.5–2 mm long; style in short-styled flowers included, 6 mm long, glabrous, the 2 ellipsoid stigmas 2 mm long, the disc 0.5 mm diam., hirtellous. Capsules and seeds unknown.

Distribution. This species is known only from the type locality in the Sierra Atravesada of Oaxaca, Mexico. Cerro Atravesada and Cerro Azul are two peaks, reaching about 1,600 m and 2,300 m, respectively, that form part of the Sierra Atravesada north of the town of Niltepec. This isolated Sierra is separate from the other mountain ranges in Oaxaca and constitutes the disjunct northwestern part of the Sierra Madre de Chiapas. Geologically it is composed of limestone and coarse-grained sandstone, a quartz brecca (MacDougall, 1971).

Habitat. MacDougall (1971) noted that the flanks of Cerros Atravesada and Azul are covered by dense, mixed evergreen rainforest and cloud forest with palms, tree ferns, and epiphyte-laden trees. The flat, boulder-strewn summits of the peaks support low elfin cloud forest with *Pinus*, *Clethra*, and Lauraceae, among other taxa. Because of its topographic isolation, the Sierra Atravesada harbors a number of disjunct plant and animal species, including the quetzal.

Rondeletia atravesadensis is allied to *R. guerrerensis* (described below) from Guerrero (Fig. 8C, D), a species differing by its larger leaves (5–15 × 2–7 cm), larger inflorescence (8–19 cm long) with more numerous (12–36) flowers, larger, foliaceous calyx lobes (2–5 × 1–2 mm), and larger corolla lobes (5–6 × 4–6 mm). *Rondeletia atravesadensis* is also closely related to *R. scoti* (Fig. 8A, B).

2. Rondeletia brandegeeana Lorence, nom. nov. Replaced name: *Otocalyx chiapensis* Brandegee, Univ. Calif. Publ. Bot. 6: 68. 1914. Non *Rondeletia chiapasensis* Standl. (1940). TYPE: Mexico. Chiapas: Cerro del Boquerón, middle region, moist valley slopes, Aug. 1913, *C. A. Purpus 7041* (holotype, UC no. 173047, photo PTBG; isotype, GH).

Tree? or shrub?, the young twigs strigillose, the trichomes simple, unicellular, whitish or pale fulvous, 0.3–0.6 mm long, the twigs 1–2 mm diam., the internodes (0.5–)1–9 cm long. Leaves opposite, those

of a pair at a node equal or subequal, petiolate; petioles 4–12 mm long, 0.5–0.6 mm diam., moderately to densely strigillose; lamina ovate or ovate-elliptic, 2.5–7 × 1.3–3.5 cm, drying brownish green, discolorous, both surfaces sparsely strigillose, the hairs denser along costa and veins, the base cuneate to rounded, occasionally attenuate, the apex long-acuminate, the acumen 1–1.5 cm long, often falcate, the 2° veins 4–6 pairs, the venation camptodromous, the venation visible to 5° on both surfaces, the margin sparsely ciliolate; stipules erect, deltoid, 1–1.5 mm long and wide basally, externally strigillose dorsally, internally densely strigillose-sericeous, margins scarious, the trichomes mixed with brown digitate colleters 0.5 mm long. Inflorescence terminal, dichasial-cymose, 4–5 cm long including the corollas, 2–3 cm wide, trichotomous (sessile) or with a single 1° axis (peduncle), the central 1° axis 1–3 cm long, often subtended by a pair of reduced leaves, bearing a cymule of 3–8 flowers, the 2 lateral 1° axes 1–2.5 cm long, each bearing a cymule of 1–3 flowers, the axes densely fulvous strigillose, the cymules subtended by linear bracteoles 2.5–3.5 mm long; flowers 4-merous, sessile or on pedicels to 1 mm long, each usually subtended by a linear strigillose bracteole 2–3 mm long, the hypanthium obconical-obovoid, 2 × 1.5 mm, densely fulvous strigillose, the calyx cup 0.3–0.5 mm deep, the lobes strigillose, unequal, 3 smaller lobes linear-subulate, erect, 2–5 × 0.5 mm, 1 larger lobe foliaceous, lanceolate or ligulate, 9–10 × 1.5–2 mm, each sinus with a single brown, digitate colleter; corolla with imbricate aestivation in bud, salverform at anthesis, the tube 10–11 mm long, 1 mm diam. medially, externally densely fulvous strigillose, internally pilose in basal ⅓, the lobes spreading, ovate or rounded, 3 × 2.5–3 mm, externally strigillose, internally sparsely papillose puberulent around throat with short, white, flat and bulbous trichomes; stamens in short-styled flowers sessile, attached 1.5 mm below throat, anthers linear-ellipsoid, 2–2.2 mm long, tips slightly exserted; style in short-styled flowers included, glabrous, 4 mm long, the ellipsoid stigmas 3 mm long; disc pilose, 0.5 mm diam., sunken below calyx lobe sinuses. Pollen 3-colporate. Capsule ovoid-ellipsoid or subglobose-ellipsoid, slightly bisulcate, 5 mm long, 4–5 mm diam., strigillose, crowned by persistent calyx lobes, dehiscence loculicidal then septicidal; seeds angulate, 0.3–0.4 mm diam., the testa dark brown, deeply foveolate, the cells 5–6-sided.

Distribution. This species is known only from the type locality on the Cerro del Boquerón in Chiapas, Mexico, where C. A. Purpus collected it in "rocky forests." No recent collections are known, suggesting that it may be extremely rare or extinct.

Additional specimens examined. MEXICO. CHIAPAS: Cerro del Boquerón, 1914, *C. A. Purpus 7041'* (UC, probable isotype); Cerro del Boquerón, rocky forests, June [year not given], *C. A. Purpus 7514* (UC).

A careful study of the holotype and two other collections of *Otocalyx chiapensis* revealed that this species agrees well with *Rondeletia* sensu lato in terms of vegetative, floral, and fruit morphology. The name *Otocalyx* refers to one of the four calyx lobes that is expanded and foliaceous. However, this feature is not inconsistent with *Rondeletia*, many species of which have one or two large, foliaceous calyx lobes. The throat and adjacent adaxial corolla lobe surfaces are sparsely bearded with short, white, bulbous and flattened hairs, a feature characteristic of *Rogiera* and *Javorkaea*. The tetramerous flowers and internally basally pilose corolla tube are features typical of *Arachnothryx*, although the pilose nectary disc is not supposed to occur in the latter genus according to Steyermark (1967). Brandegee's (1914) statement in the protologue that *Otocalyx* is characterized by baccate fruits and a unilocular ovary with numerous ovules on a dorsifixed, laminar placenta, features that are ". . . peculiar for a Rubiaceous genus, resembling those of some species of Gesneriaceae," is clearly erroneous. In his Rubiaceae treatment for *North American Flora*, Standley (1934: 181–182) placed *Otocalyx* in the Gardenieae tribe because of its supposedly fleshy fruit, a feature he questioned, although he did recognize the bilocular nature of the ovary.

My examination of the fruits of *Otocalyx chiapensis* revealed that they are clearly capsular and bilocular, each locule having an elongate, peltate placenta with numerous seeds. Dehiscence appears to be at first loculicidal (as in *Rondeletia*), then septicidal (as in *Arachnothryx*). The numerous seeds are nonwinged and angulate with a deeply foveolate testa consisting of 5–6-sided cells, a feature characteristic of *Arachnothryx*. For these reasons I have decided to transfer *Otocalyx chiapensis* to the genus *Rondeletia* as *R. brandegeeana* and have provided an emended description of the species. This species combines key characters of *Rondeletia*, *Rogiera*, and *Arachnothryx*, thus undermining the validity of the latter two genera. *Rondeletia brandegeeana* seems most closely related to *R. atravesadensis* and *R. rzedowskii*, both referable to Standley's *Calycosae* group.

3. Rondeletia dwyeri Lorence, nom. nov. Replaced name: *Chomelia leucophylla* Dwyer,

Ann. Missouri Bot. Gard. 67: 98, fig. 21. 1980. Non *Rondeletia leucophylla* HBK (1820). TYPE: Panama. Darién: slopes of Cerro Chucula, drainage of Río Pavarando, 11 Feb. 1972, *A. Gentry 4262* (holotype, MO; isotype, MO).

Trees 5–15 m tall, the twigs 1.5–2.5 mm diam., covered by a white or pale brown, matted arachnoid tomentum when young, glabrescent, the internodes 1–5 cm long. Leaves opposite, those of a pair at a node subequal to unequal, one up to twice as large as the other, shortly petiolate; petioles 4–20 mm long, 0.8–1.5 mm diam., arachnoid tomentose when young; lamina elliptic, obovate-elliptic, or broadly obovate-elliptic, (5–)8–21.5 × (2–)3.5–11 cm, the base cuneate, obtuse, rounded, or truncate, the apex acute or shortly acuminate, the acumen to 1.5 cm long, occasionally falcate, the lamina chartaceous, drying greenish brown, strongly discolorous, adaxially sparsely flocculose tomentose when young, glabrescent, abaxially densely and persistently white pannose or arachnoid tomentose, the 2° veins 7–8 pairs, arcuate, camptodromous, the venation raised and visible to 5° adaxially and to 4° abaxially, the margin thin, slightly revolute; stipules ligulate or lanceolate, erect, thin, brown, foliaceous, 4–8 × 1.5–2.5 mm, externally sparsely arachnoid tomentose basally, internally more densely so, with long, white, sericeous trichomes basally. Inflorescence terminal or axillary on short shoots at leafless nodes, a reduced, 5–27-flowered thyrsoid cyme 2.5–4 × 2–3 cm (including corollas), the peduncle 3–8 mm long or sessile and branched from the base, the 1° branches 1–3 pairs, 1–13 mm long, each bearing 3–6 flowers in dichasia or a single flower, the axes densely whitish or tan arachnoid tomentose, subtended by subulate bracteoles 2 mm long; flowers distylous, 4-merous, sessile or on pedicels to 1 mm long, each subtended by a subulate bracteole 2–2.5 mm long; hypanthium turbinate or ovoid, bisulcate, 1.5–2 × 1–1.5 mm, the calyx lobes subequal, narrowly triangular, subulate, or ovate-elliptic and foliaceous, 1–5 × 0.8–4 mm, becoming reflexed, externally tomentose, internally glabrous and venose, each sinus with 6–8 sessile, brown colleters, calyx cup 0.3–0.5 mm deep; corolla when fresh pink or orange-brown, or lobes cream, center lilac and tube red, salverform at anthesis, the tube 9–13 mm long, 0.8–1.2 mm diam. medially, externally moderately to densely arachnoid tomentose, internally villous in basal ⅓, the lobes broadly elliptic or obovate, spreading, 3–4 × 2.5–3 mm, obtuse, margins undulate or crisped, externally flocculose tomentose, stamens sessile, anthers linear-ellipsoid, 2–2.2 mm long, in long-styled flowers attached 4–5 mm below throat, in short-styled flowers attached 1–2 mm below throat, style glabrous, in long-styled flowers 11 mm long, tip exserted, in short-styled flowers 6–7 mm long, tip included, stigmas linear, 2–3 mm long, disc glabrous, 0.8 mm diam. Capsules broadly ovoid or broadly ellipsoid, 5–6 mm long, 3–5 mm diam., slightly bisulcate, weakly 8-ribbed, pale brownish arachnoid tomentose, dehiscence loculicidal then septicidal; seeds light brown, sharply angulose, 0.3–0.5 mm diam.

Distribution. Rondeletia dwyeri is known from the provinces of Colón and Darién in Panama.

Habitat. It occurs in lowland tropical rainforest, often along rivers and streams, from near sea level to about 600 m. Flowering occurs from January to April, closely followed by fruiting.

Additional specimens examined. PANAMA. COLÓN: trail along first river W of Portobelo, *Gentry 5145* (F, MO); lower Río Guanche, *Dressler 4346* (F, MO); Río Guanche, 3 km upriver from bridge on road to Portobelo, 25 m, *Mori & Kallunki 5181* (MO), *Antonio 4831* (MO); along Río Guanche, 1–4 km S of Portobelo Highway, 9°30′N, 79°40′W, 0–50 m, *S. Knapp et al. 4601* (MO, PTBG); Río Trapiche, 5 m, *Holdridge 6452* (MO); end of Río Boquerón road, forest on ridge W of road end, 1,500–2,000 ft., *Hammel 2447* (MO); Río Iguanita, to 3 mi. upstream from sea, 0–500 m, *D'Arcy & Croat 13605* (MO); Río Iguanita and inland to 2 km, 0–50 m, *D'Arcy 14610* (MEXU, MO). DARIÉN: rocky banks of stream at Ensenada del Guayabo, 18 km SE of Jaqué, *Garwood et al. 107* (F), *Garwood et al. 282* (MO); 16–19 km SE of Jaqué, *Garwood 988* (MO); 10 km NE of Jaqué, slopes of Río Tabuelitas above Biroqueirá, Indian village on Río Jacqué below mouth of Río Pavarando, to 400 ft., *Sytsma & D'Arcy 3320* (MEXU, MO), *D'Arcy & Sytsma 14481* (MO); headwaters of Río Tabuelita & ridge to Río Pavarando, 10 km NE of Jaque, 150–500 m, *D'Arcy & Sytsma 14604* (MO).

Examination of flowering and fruiting collections of *Chomelia leucophylla* Dwyer revealed that this species actually belongs in the genus *Rondeletia;* an expanded description is therefore given above. The floral morphology, capsular fruits with axile placentation and loculicidal, then septicidal dehiscence, and numerous small, angular seeds are all characteristic of *Rondeletia*. The white, arachnoid-tomentose pubescence of the lower leaf surface and corolla tube, and short, terminal and axillary inflorescences of *R. dwyeri* are distinctive among Panamanian species and suggest placement in Standley's (1918) *Leucophyllae* or *Laniflorae*, groups that share many features and should be combined. *Rondeletia dwyeri* is most closely related to *R. dariensis* Standl., which differs by its larger, more open inflorescences, flowers with pedicels 1–11 mm long, and much larger, foliaceous calyx lobes 10–13 × 2–4 mm. I am pleased to name this species for my

mentor and collaborator, John D. Dwyer, whose studies of tropical American Rubiaceae have contributed greatly to our understanding of this large and complex family.

4. Rondeletia ginetteae Lorence, sp. nov. TYPE: Mexico. Oaxaca: Distrito de Tuxtepec, Ruta 175 Tuxtepec to Oaxaca, ca. 10 km S of Valle Nacional, Sierra de Juárez, ca. 750 m, 6 Dec. 1980, *D. H. Lorence & R. Cedillo T. 2973* (holotype, MEXU, photo PTBG; isotype, F, photo PTBG). Figure 2A–G.

Species *Rondeletiae acuminatae* (Oerst. ex Standl.) Lorence & Castillo-Campos affinis, inflorescentia elongata spiciforme 3–6 pares cymarum parvarum dense conglomeratarum ferente, floribus cum lobis calycinis minoribus subaequalibus, corolla cum tubo roseo et lobis extus rubello-purpureis et capsulis subglobosis minoribus 4–5 mm diametro, differt.

Shrubs 1–2 m tall, the young twigs densely hirsutulous to hirsute, the trichomes brown or purple, to 1 mm long, the twigs dark brown, 1–2 mm diam., the internodes 1–10 cm long. Leaves opposite, those of a pair at a node subequal or unequal, one occasionally up to 6 times larger than the other, shortly petiolate or subsessile; petioles 1.5–3 mm long, 1–1.5 mm diam., densely hirsutulous-hirsute; lamina elliptic or obovate-elliptic, (5–)9–23 × (2–)4–11 cm, often somewhat falcate, chartaceous, drying green or pale brownish green, slightly discolorous, adaxially hirsutulous, especially along the costa and 2° veins, abaxially more densely whitish hirsutulous or villosulous, the trichomes longer and denser along the costa and veins, the base obtuse, rounded, or subcordate, the apex shortly acuminate, the acumen 1–3 cm long, often falcate, the 2° veins 7–10 pairs, camptodromous or weakly brochidodromous, the 2°(–3°) veins depressed adaxially, the venation very prominent and visible to 4° on both surfaces, finely reticulate, the margin ciliolate; stipules erect, elliptic-lanceolate, acuminate, 8–13 × 1.5–3 mm, thin, brown, externally strigose especially basally and along margins, internally densely short strigose, with a ring of white trichomes 1–2 mm long basally. Inflorescence terminal, cymose, thyrsiform-spiciform, 5.5–8 × 3–4 cm including the corollas, the peduncle 1–4.5 cm long, the flowers numerous, the axes hirtellous-tomentose, brownish purple, the primary branches 3–6 pairs, crowded along the rachis, bearing sessile or subsessile glomerulate cymules of 4–6 flowers, subtended by thin, 2–3-lobed bracteoles 4–5 mm long; flowers 4-merous, sessile, the hypanthium obconic, 1–1.5 × 1 mm, the thin calyx purplish brown, externally densely arachnoid tomentose, internally strigillose, the calyx cup 1–1.5 mm long, the lobes subequal, ovate or elliptic, 4–7 × 1.5–2.5 mm, venose, apically acuminate, internally with 2 or 3 reddish colleters in each sinus; corolla reddish purple in bud, at anthesis salverform, tube externally densely arachnoid tomentose, brownish pink, 13–15 mm long, 2–2.5 mm diam., internally villosulous basally, the lobes ovate or rounded, obtuse, 2.5–3.5 mm long and wide, spreading, externally reddish purple basally, tomentose, internally glabrous, white, the margin crisped; stamens 4, in short-styled flowers sessile, attached 1–1.5 mm below throat, anthers 2–2.5 mm long, ellipsoid, tips exserted; style in short-styled flowers glabrous, included, 8 mm long, the ellipsoid stigmas 2 mm long. Capsule subglobose-ellipsoid, 4–5 × 4–5 mm, hirtellous, crowned by the persistent calyx lobes, dehiscence loculicidal then septicidal; seeds angulate, 0.4–0.7 × 0.3–0.4 mm, the testa reticulate, dark brown.

Distribution. Known only from the lower northern slopes of the Sierra de Juárez in Oaxaca, Mexico.

Habitat. Rondeletia ginetteae occurs in lower montane tropical evergreen rainforest with *Terminalia amazonia*, *Dussia mexicana*, and *Swartzia* from about 150 to 900 m (not 1,600 m as erroneously indicated on the isotype). The type was collected from a wet, vertical rock face in a shady arroyo. Flowers were collected in December and January, and fruits were found in April.

Additional specimens examined. MEXICO. OAXACA: District of Tuxtepec, 5 km N of Valle Nacional, 150 m, *Breedlove & Almeda 56774* (CAS); Distrito de Ixtlán, Mun. de Comaltepec, Sierra de Juárez, Ruta 175 a 2.5 km al NE de Puerto Eligio, 900 m, *Cedillo T. & Lorence 2395* (BM, MEXU, MO, PTBG).

Because of its somewhat elongate, spiciform-thyrsiform inflorescence and tetramerous flowers, *Rondeletia ginetteae* keys out to the *Laniflorae* group in Standley (1918). It is, however, clearly most closely related to *R. acuminata* (Oerst. ex Standl.) Lorence & Castillo-Campos and also to *R. macrocalyx* Standl. & Steyerm., both of which obviously belong in Standley's *Calycosae* group. This again underscores the artificiality of these groups. Although it occurs in the same region as the latter two species, *R. ginetteae* is readily distinguished by its elongate, spiciform inflorescence with flowers in paired, densely glomerulate cymules, smaller subequal calyx lobes, arachnoid-tomentose corolla with a brownish pink tube and externally reddish purple lobes toward the base, and smaller, subglobose capsules. It is with pleasure that I name this species

Figure 2. *Rondeletia ginetteae* Lorence. —A, B. Habit. —C. Corolla of short-styled flower, opened to show stamens. —D. Calyx, seen from above. —E. Style of short-styled flower. —F. Dehisced capsule. —G. Seed. A–E, *Lorence & Cedillo T. 2973* (F); F, G, *Cedillo T. & Lorence 2395* (PTBG).

for my wife, Ginette, frequent field companion and dearest friend.

5. Rondeletia guerrerensis Lorence, sp. nov. TYPE: Mexico. Guerrero: Municipio de Atoyac de Alvarez, a 23.5 km al NE de El Paraiso, camino Atoyac–Puerto del Gallo, 1,700 m, 22 Nov. 1983, *E. Martínez S. & F. Barrie 5596* (holotype, MEXU, photo PTBG; isotypes, BM, CAS, CHAPA, F, MO, PTBG). Figure 8C, D.

Species *Rondeletiae leucophyllae* HBK affinis, a qua corolla albo-rosea dense velutino-tomentosa cum tubo crassioro 0.5–0.7 mm diametro differt.

Shrub or treelet 2.5–4 m tall, the twigs 1.5–3 mm diam., becoming longitudinally fissured, persistently strigillose-hirtellous or velutinous, the trichomes to 0.6 mm long, flattened, twisted, white or pale brown, the internodes 0.5–6.5 cm long. Leaves opposite, those of a pair at a node subequal or unequal, one up to twice as large as the other, petiolate; petioles 0.5–2.1 cm long, 0.5–1 mm diam., densely velutinous; lamina ovate-elliptic or elliptic, (3–)5–15 × (1–)2–7 cm, membranaceous or chartaceous, drying green or brown, slightly discolorous, adaxially often lustrous, sparsely strigillose-hirtellous, the hairs denser on costa and 2° veins, abaxially with sparse to moderately dense, whitish flocculose-arachnoid pubescence over entire surface, denser on costa and veins and mixed with scattered curved or straight hairs, the base cuneate, narrowly cuneate, or attenuate, rarely obtuse, the apex acuminate or acute, the acumen 7–15 mm long, the 2° veins 6–9 pairs, acrodromous, the venation visible to 5° on both surfaces; stipules narrowly triangular or subulate, 2–5 × 1–3 mm, appressed, persistent, externally strigose, internally densely white velutinous, the hairs interspersed with several brown, digitate colleters 0.5 mm long, the margins entire. Inflorescence terminal, usually solitary, rarely in groups of 2–3, cymose, a thyrsiform pleiochasium 8–19 × 3–7 cm including the corollas, cylindrical or broadest basally, 12–36-flowered, the peduncle 2–6 cm long, 1–1.5 mm diam., the peduncle and axes densely strigillose-velutinous, the primary branches 2–4 pairs, the lower pair 3–12 mm long, the upper pairs shorter or sessile, each branch subtended by a linear-subulate bract to 1 cm long or a reduced leaf and terminated by 1(–2) cymules of 3–4(–5) flowers; flowers 4(–5)-merous, sessile or the pedicels to 1 mm long, subtended by a small bracteole, the hypanthium subglobose or turbinate, 1–1.5 × 1.5 mm, densely whitish velutinous, the calyx cup 0.5–0.6 mm deep, internally glabrous, externally velutinous-tomentose, the calyx lobes 4, somewhat unequal, ovate-elliptic or ligulate, foliaceous, 2–5 × 1–2 mm, apically acute, erect-spreading, venose, externally densely flocculose-tomentose, internally densely strigose, each sinus with 3–8 white or red colleters; corolla pink or pinkish white when fresh, salverform at anthesis, the tube 10–17 mm long, 1–1.5 mm diam. medially, externally villous, internally pilose in the basal ⅓–½, the lobes 4(–5), suborbicular or obovate, 5–6 × 4–6(–8) mm, spreading, glabrous, the margin undulate or erose-incised, the throat glabrous; stamens 4, in long-styled flowers included, sessile, attached 2.5–3 mm below the throat, in short-styled flowers attached at the throat, the tips exserted for 1 mm, the anthers ellipsoid, 2–3 mm long; style in long-styled flowers 12–19 mm long, exserted for 2 mm, in short-styled flowers 7–9 mm long, included, the 2 stigmas 1–2.5 mm long, linear-ovoid, the disc glabrous. Capsules broadly ellipsoid or subglobose, 6–7 mm long, 4–5 mm diam., bisulcate, hirtellous-velutinous, the dehiscence loculicidal then septicidal; seeds angulate, 0.5–0.6 mm long, the testa reticulate, light brown.

Distribution. Known only from the Sierra Madre del Sur of Guerrero, Mexico.

Habitat. Rondeletia guerrerensis occurs in montane cloud forest with *Quercus*, *Abies*, and *Pinus* from about 1,700 to 1,900 m. Flowers were collected in October, November, and January and old fruits were found in November.

Additional specimens examined. MEXICO. GUERRERO: Cerro Teotepec y alrededores, *L. Paray 4056* (MEXU); Galeana District, Carrizo–Pie de la Cuesta, 1,750 m, *Hinton et al. 14738* (F, MO); 14 km al SSW del Campamento El Gallo, camino a Atoyac, estribaciones suroccidentales del Cerro Teotepec, 1,900 m, *Rzedowski & McVaugh 81* (ENCB, XAL).

Rondeletia guerrerensis is most closely allied to *R. leucophylla*, a species also having leaves that are densely white arachnoid tomentose or pannose below, at least when young. *Rondeletia leucophylla*, including *R. leptodictya* Standl. and the synonyms listed by Standley (1918: 54), is extremely variable in leaf size and shape as well as length of inflorescence branches and peduncles. However, the corollas of *R. leucophylla* are consistently more slender (1.2–1.5 mm diam. distally and 0.5–0.7 mm medially), deep pink to blood red when fresh, and externally arachnoid pannose with a cobwebby tomentum of fine, matted white hairs (occasionally mixed with crisped antrorse hairs), whereas corollas of *R. guerrerensis* are thicker (1.8–2 mm diam. distally and 1–1.5 mm medially), pink or white tinged with pink when fresh, and externally veluti-

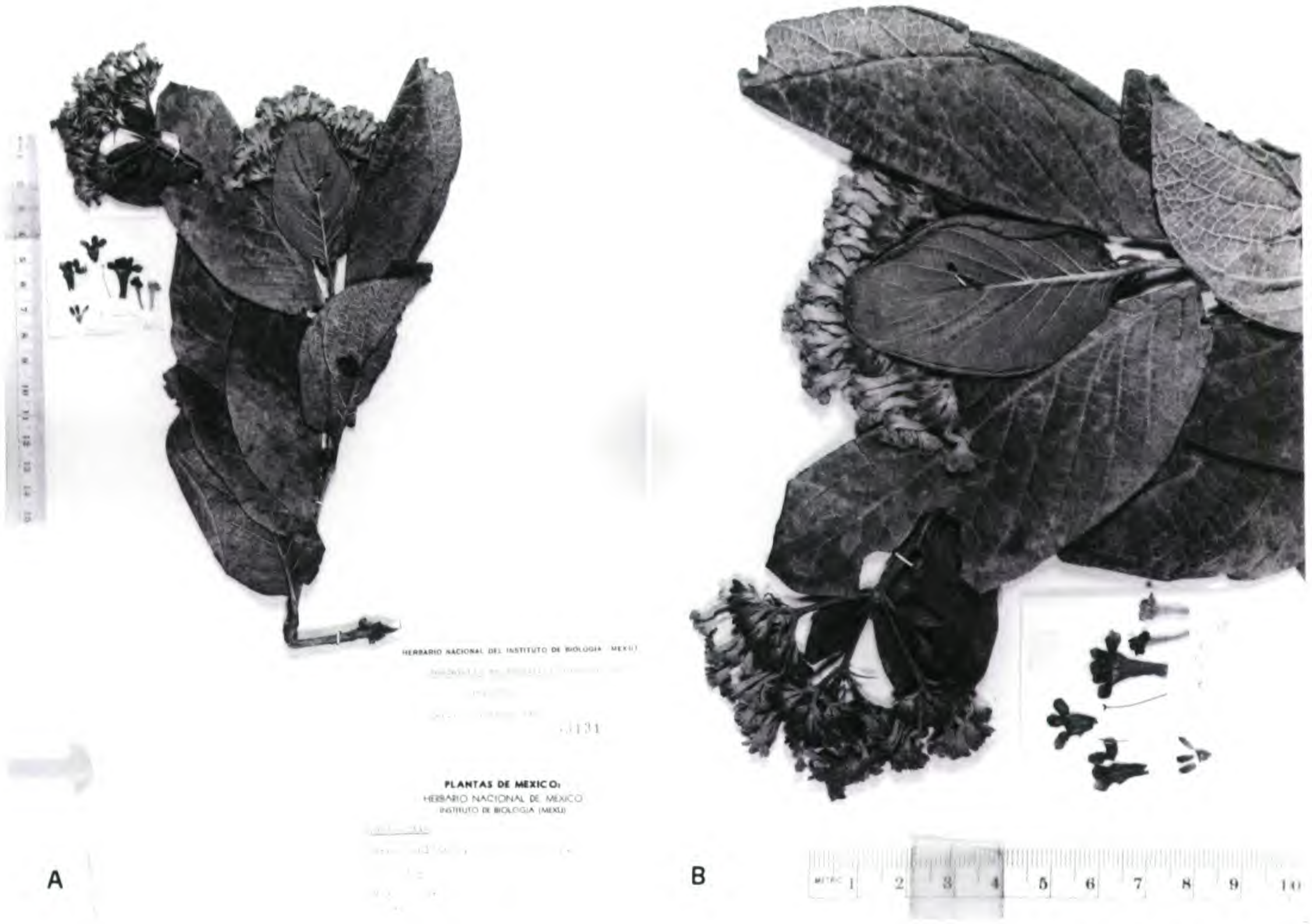

Figure 3. —A, B. *Rondeletia macdougallii* Lorence. *MacDougall s.n.* in 7 Mar. 1956 (holotype, MEXU).

nous tomentose with straight or crisped, pale yellowish white antrorse hairs. In addition, *R. leucophylla* differs by its dense, white arachnoid-pannose tomentum (sometimes mixed with crisped or straight hairs) on the petioles, young twigs, and inflorescence parts. *Rondeletia guerrerensis* is intermediate between Standley's (1918) *Laniflorae* and *Leucophyllae* groups, which are in turn linked to his *Calycosae* group by species such as *R. ginetteae* (q.v.).

6. Rondeletia macdougallii Lorence, sp. nov. TYPE: Mexico. Oaxaca: Cerro Azul (top), N of Niltepec, 7,000 ft., dwarf shrub, flowers pink, 7 Mar. 1956 (fl), *T. MacDougall s.n.* (holotype, MEXU, photo PTBG). Figure 3A, B.

Species *Rondeletiae gratissimae* (Planch. & Linden) Hemsl. affinis, sed foliis late ovatis, lamina bullata obtusa 58–105 × 33–64 mm, inflorescentia floribusque dense fulvostrigosis, calycis lobis foliaceis longioribus 3–4 × 1.2–1.8 mm, corolla breviore dense strigosa et tubo 8–12 mm longo differt.

Densely branching shrub about 1 m tall, the twigs 3–4 mm diam., compressed, densely strigose when young, the trichomes fulvous, simple, to 1 mm long. Leaves opposite, shortly petiolate, those of a pair at a node equal; petioles 5–10 mm long, 2–2.5 mm diam., stout, terete, adaxially narrowly sulcate, strigose; lamina ovate to broadly ovate-elliptic, 5.8–10.5 × 3.3–6.4 cm, the base rounded to subtruncate, the apex obtuse or rounded, the tip often folded under, the lamina drying greenish brown, slightly discolorous, coriaceous, bullate, adaxially sparsely strigillose when young, glabrate, abaxially strigillose along the costa and veins, the 2° veins 7–9 pairs, weakly festooned brochidodromous, the 3° veins oblique, the venation deeply sunken adaxially and visible to 5°, abaxially prominent and yellowish, visible to 4°, the margin thick, revolute; stipules erect, persistent, subulate or narrowly triangular, acuminate from a broad base, 6–9 mm long, 3–4 mm wide basally, coriaceous, involute, externally densely strigose. Inflorescence terminal, cymose-corymbose, rounded, 6.5–7.5 × 6.5–7 cm including the corollas, branching to 3°, the axes densely fulvous

strigose, the peduncle 2–2.5 cm long, 1.5–2 mm diam., the 1° branches 3, these 1.5–2 cm long, subtended by a pair of reduced leaves, the 2° branches, cymules and flowers often subtended by linear-ligulate or oblanceolate-strigillose bracteoles 2–7 mm long; flowers 5-merous, subsessile or on pedicels to 1.5 mm long, the hypanthium densely fulvous strigose, 1.5–2 × 1.3–1.6 mm, the calyx cup 0.2 mm deep, the lobes subequal, foliaceous, obovate-elliptic, 3–4 × 1.2–1.8 mm, thick, erect, obtuse or rounded apically, strigillose especially basally and internally, each sinus with a small white colleter; corolla pink when fresh, at anthesis narrowly funnelform, the tube 8–12 mm long, 1–1.5 mm diam. medially, flaring to 2–2.5 mm diam. distally, externally densely fulvous strigose, internally sparsely villosulous, the throat densely yellow barbate, the lobes spreading to 90°, broadly elliptic to subcircular, 2–4 × 2–3.5 mm, externally strigillose-tomentose, internally farinose-puberulent basally, the margins entire to crenulate; stamens in long-styled flowers included, the anthers linear-ellipsoid, 2 mm long, the filaments 1 mm long, affixed 3–3.5 mm below the throat; style glabrous, in long-styled flowers exserted 1–2 mm from the throat, 9–12 mm long, the 2 ellipsoid stigma lobes 0.8–1 mm long, the disc 1.5 mm diam. Capsules and seeds unknown.

Distribution. Known only from the type locality in the Sierra Atravesada in southeastern Oaxaca (see comments under *Rondeletia atravesadensis*).

Habitat. *Rondeletia macdougallii* occurs in elfin cloud forest on the summit of Cerro Azul.

This species is pictured in flower in MacDougall (1971: 94). Its pentamerous flowers with a densely yellow barbate corolla throat place *Rondeletia macdougallii* in Standley's (1918) *Amoenae* (equivalent to the genus *Rogiera*), a group of predominantly Mexican and Central American species. Among the species of this group, *R. macdougallii* seems most closely related to *R. gratissima* (syn. *R. seleriana* Loesener), a rainforest species from Chiapas and Guatemala. The latter species is also characterized by having thick, erect, nonfoliaceous stipules and coriaceous leaves but differs in having smaller, nonbullate, acuminate leaves, much more sparsely pubescent inflorescence and flowers, and flowers with much shorter, acute calyx lobes and a longer, more slender corolla tube 12–16 mm long. By its inflorescence structure and bullate leaves *R. macdougalii* also resembles *R. amoena* (Planch.) Hemsl., but in the latter species the stipules are 10–15 mm long, foliaceous, and reflexed. I am pleased to name this species for the late Thomas Baille MacDougall, an intrepid botanical explorer and naturalist who spent each winter in the Isthmus of Tehuantepec, Oaxaca, collecting botanical and zoological specimens (Stix, 1975). The two main sets of MacDougall's botanical collections, mostly unicates, are deposited in the MEXU and NY herbaria.

7. Rondeletia manantlanensis Lorence, sp. nov.
TYPE: Mexico. Jalisco: Mpio. de Autlán, Cañada del Laurelito, Las Joyas, bosque mesófilo de montaña, 1,850 m, 7 Dec. 1985, *A. Vázquez 3750* (holotype, WIS, photo PTBG; isotype, IBUG not seen). Figure 4A, B.

Species *Rondeletiae buddleioides* Benth. affinis, axibus inflorescentiae caulibusque hirtello-villosis, pagina adaxiali laminae hirtello-strigillosa, corolla rosea vel rubra extus arachnoideo-tomentosa differt.

Shrub 1.2–5 m tall, twigs terete to slightly quadrangular, 1.2–2 mm diam., when young densely villous, the trichomes pale brownish white or buff, 0.5–1 mm long, flattened, twisted, septate; internodes 1.5–6 cm long. Leaves opposite, those of a pair at a node subequal to unequal, petiolate; petioles (2–)5–25 mm long, 0.7–1.2 mm diam., densely villous, winged distally; lamina elliptic to narrowly elliptic, (3.5–)5–16 × (1–)2–5.5 cm, the base narrowly cuneate to attenuate, the apex acute, the tip acuminate, 1–2 cm long, the lamina chartaceous, drying strongly discolorous, adaxially green or brownish green, short-strigose or hirsutulous with scattered hairs, denser on costa and veins, abaxially densely and persistently white arachnoid pannose, short-strigose or hirsutulous on veins and costa, the 2° veins (6–)7–9(–12) pairs, weakly festooned brochidodromous, the venation visible to 4° adaxially, to 3° abaxially, the margin ciliate; stipules narrowly subulate-acuminate, 3–7 mm × 1–2.5 mm, dorsally carinate, externally glabrous, internally densely villous, with 4–5 dark brown digitate colleters. Inflorescence terminal, a narrow, elongate, spiciform cyme, 11–16 × 2–3 cm including the corollas, the peduncle 1.5–4 cm long, 0.6–1 mm diam., sparsely to densely villose-hirtellous, the lateral branches 10–14 pairs, the 2° axes 2–6 mm long, villose-hirtellous, each subtended by a narrowly subulate, ciliolate bracteole 2–5 mm long, ending in 1–2 cymules of (1–)2–5 flowers; flowers 4-merous, distylous, sessile or on villose-hirtellous pedicels 1–2 mm long, each subtended by a linear-subulate bracteole 1–2 mm long with a pair of reddish colleters basally on margins, the hypanthium subglobose-turbinate, 1 × 0.8–1 mm, densely white arachnoid tomentose, the calyx cup 0.3–0.5 mm deep, the calyx lobes subequal to unequal, erect in flower, reflexed in fruit, narrowly deltoid or linear-subulate, the 1 large lobe (1–)2–3

Figure 4. —A, B. *Rondeletia manantlanensis* Lorence. *Vázquez 3750* (holotype, WIS).

× 0.5 mm, the 3 smaller lobes (0.5–)1–2 × 0.2–0.4 mm, externally strigillose, arachnoid tomentose toward base, the margins ciliolate, each sinus with a small, conical reddish colleter; corolla when fresh rose-colored or dark red, at anthesis salverform, the tube 5.5–7 mm long, 0.6–1 mm diam. medially, to 1.5 mm diam. distally, externally white arachnoid tomentose or flocculose, more densely so distally, internally sparsely hirtellous-villosulous toward base, with a villosulous ring basally, the lobes spreading 90°, subcircular or obovate, 1.5–2 × 1.5–2 mm, the margins erose-crisped, the stamens sessile, the anthers linear-ellipsoid, 1 mm long, in short-styled flowers affixed 0.7 mm below throat, in long-styled flowers affixed 1.5 mm below throat; style glabrous, in short-styled flowers 2.5 mm long, in long-styled flowers 8 mm long, the stigmas linear-ellipsoid, 0.7 mm long, the disc annular, glabrous, 0.4–0.5 mm diam. Mature fruits and seeds not seen.

Distribution. Rondeletia manantlanensis is known only from the Sierra de Manantlán region in southern Jalisco.

Habitat. This species occurs in montane cloud forest associated with *Ardisia*, *Carpinus*, *Chusquea*, *Cornus*, *Conostegia*, *Magnolia*, *Meliosma*, *Oreopanax*, *Quercus*, *Rhamnus*, *Tilia*, Lauraceae, and Theaceae from 1,820 to 2,050 m. Flowering specimens were collected in December and January.

Additional specimens examined. MEXICO. JALISCO: Sierra de Manantlán Occidental, headwaters of Arroyo Las Joyas, 2–3 km ESE of Las Joyas, *Iltis & Guzman M. 29067* (MEXU, WIS); Arroyo El Chilacayote al "Cerro La Piedra Bola," 2.5–3 km NE de la Estación Biológica "Las Joyas" ("Zarzamora"), *Judziewicz et al. 4875* (WIS); Estación Biológica "Las Joyas," 1.5 km al SE de Las Joyas, *Cochrane & Judziewicz 10653* (WIS).

Rondeletia manantlanensis is most closely related to *R. buddleioides*, a widespread and variable species ranging from southern Mexico through Panama. The latter species, however, has strictly arachnoid-tomentose or pannose pubescence on its stems, leaves, and inflorescence. This new species represents a narrow-ranging vicariant presumably derived from *R. buddleioides*. This also seems to be the case for many other species in this complex, in-

Figure 5. —A, B. *Rondeletia monteverdensis* Lorence. *Haber 2340* (holotype, MO).

cluding *R. albida* Lundell, *R. pyramidalis* Lundell, and *R. ovandensis* Lundell, all from Chiapas, and *R. laniflora* Benth. from Chiapas and Guatemala. *Rondeletia manantlensis* is also closely related to *R. villosa* Hemsl. from Oaxaca, Chiapas, and Tabasco, a species differing by its much larger, externally villose stipules 15–25 × 5–10 mm, larger leaves 10–23 × 3.5–8.5 cm, and longer inflorescences 10–24 cm long with white corollas.

8. Rondeletia monteverdensis Lorence, sp. nov.
TYPE: Costa Rica. Puntarenas: Monteverde Reserve, road to TV tower, elev. 1,700 m, 24

Aug. 1985, *W. A. Haber 2340* (holotype, MO no. 3595758, photo PTBG). Figure 5A, B.

Species *Rondeletiae calycosae* J. D. Sm. affinis, a qua ramunculis petiolisque glabrescentibus, foliis ternatis, et corolla alba glabra differt.

Trees or treelets 2–7(–16) m tall, rarely shrubby, the trunk to 15 cm diam., the twigs slender, 0.8–2 mm diam., trigonous to cylindrical, when young with scattered, white, straight or curved, adpressed hairs to 1 mm long, soon glabrate, the internodes 0.5–4 cm long. Leaves in whorls of 3, those at a node subequal to unequal, the smallest 50% smaller than the largest, petiolate; petioles 2–8 mm long, 0.5–1 mm diam., narrowly winged, with scattered white hairs when young, soon glabrate; lamina elliptic, narrowly elliptic, or narrowly ovate-elliptic, 3–8 × 1–2.5 cm, stiffly chartaceous, drying slightly discolorous, when young both surfaces with scattered, white, sericeous or strigose hairs to 1 mm long, adaxially soon glabrate, the hairs often persisting abaxially along costa and veins, the base acute, the apex acute with an abrupt, straight or falcate acumen 1–1.5 cm long, the 2° veins 5–7 pairs, arcuate, camptodromous, the venation adaxially obscure and visible to 2°(–3°), abaxially dark and visible to 4°, the margin slightly revolute; stipules narrowly triangular, acuminate, erect, rigid, dark brown, 1–3 × 1–2 mm basally and united into a short sheath 0.5–0.7 mm long, externally sparsely strigillose, internally densely white sericeous, the margins with 2–3 pairs of brown, cylindrical colleters. Inflorescence terminal, corymbiform-cymose, 4.5–8(–12) × 4–5 cm (including the corollas), 15–30-flowered, the peduncle 2–3(–7) cm long, 0.5–1.2 mm diam., the axes sparsely sericeous or strigillose, the 1° branches in 2 whorls of 3 separated by a short internode 6–20 mm long, each 1° branch 4–15 mm long, subtended by a lanceolate-elliptic, foliaceous bract 7–17 × 2–3 mm, terminating in dichasia of 3–5 flowers; flowers 4-merous, distylous, on strigose-sericeous pedicels 1–3 mm long, subtended by foliaceous bracteoles 4–5 mm long, the hypanthium obovoid-ellipsoid, 1.5 × 1 mm, sparsely strigose or glabrate, the calyx cup 0.5–0.6 mm deep, the calyx lobes unequal, erect-spreading, foliaceous, whitish green, venose, the 2–3 smaller linear-ligulate, 5–7 × 0.8–1 mm, the 1–2 larger lobes oblanceolate, 8–11 × 1.5–2 mm, the apex acute or rounded, each sinus with a single, sessile black colleter; corolla salverform at anthesis, white when fresh (or pink in bud), the tube 13–15 mm long, 1–1.2 mm wide medially, externally glabrous, internally sparsely hirtellous in basal ⅓–½, the lobes spreading, subcircular, 3–4 × 3–4 mm, margin undulate, externally glabrous or with scattered hairs, internally papillose-puberulent around throat, stamens sessile, anthers linear-ellipsoid, 2.5–3 mm long, in long-styled flowers attached 5 mm below throat, in short-styled flowers attached 1.5–2 mm below throat, the tips visible, the style glabrous, 12 mm long in long-styled flowers, 5–8 mm long in short-styled flowers, the stigmas 1.5–2 mm long, linear-elliptic, disc glabrous, 0.5–0.7 mm diam. Capsules obovoid-ellipsoid, 4–5 × 2.5–4 mm, bisulcate, 8-ribbed, glabrous or with scattered hairs, the calyx lobes persistent; mature seeds not seen.

Distribution. Known only from Costa Rica, in and around the Monteverde Biological Reserve on the Cordillera de Tilarán (continental divide) separating the Alajuela, Puntarenas, and Guanacaste provinces, and on the Volcán Cacao in Guanacaste.

Habitat. Premontane and lower montane rainforest and cloud forest formations, from 1,200 to 1,700 m. Flowers were collected from February to August and fruits from August to November. Of the seven flowering collections examined, six had short-styled flowers and only one had long-styled flowers. It is uncertain whether these data signify a trend toward homostyly or are merely an artifact of the small sample size.

Additional specimens examined. COSTA RICA. GUANACASTE: región del Volcán Cacao, Rancho Harold, 700–1,200 m, *Chacón & Chacón 2151* (MO). PUNTARENAS: Monteverde, 1,420 m, *Haber & Bello C. 1647* (MO), 1,700 m, *Haber 2341* (MO), 1,300 m, *Solomon 5379* (MO), *Lawton 1143* (F); NE section of preserve, 1,600–1,700 m, *Utley & Utley 2394* (F, MO); Monteverde community along Chimoco Trail, from Penas Blancas road to Río Guacimal, 4,100 ft., *Primack et al. 425* (MO); Monteverde, Chomogo, Reserva Biológica, *Poveda 1121* (MO); about 2–5 km E and SE of Monteverde, 1,580–1,700 m, *Burger & Gentry, Jr. 8643* (F, MO), *Burger & Gentry, Jr. 8712* (F), 1,450–1,650 m, *Burger & Baker 9714* (F, MO); Monteverde, 1,550 m, *Haber 523* (MO). ALAJUELA, PUNTARENAS, Y GUANACASTE: Cordillera de Tilarán, 1,450–1,500 m, *Dryer 80* (F, MO).

Rondeletia monteverdensis is referable to the *Calycosae* group of Standley (1918) and is closely related to *R. calycosa*, with which it has been confused in the herbarium. The latter species differs by its opposite leaves, persistent strigose pubescence on the stems, leaves, and inflorescence, paired inflorescence branches, and dark pink or rose red corollas with a densely strigose tube without.

9. Rondeletia purpurea Lorence, sp. nov. TYPE: Mexico. Oaxaca: Distrito de Ixtlán, Sierra de Juárez, Ruta 175 Tuxtepec a Oaxaca, a 5 km al N de Vista Hermosa, 1,175 m, *D. H. Lor-*

Figure 6. *Rondeletia purpurea* Lorence. —A, B. Habit. —C. Calyx, showing one foliaceous lobe. —D. Open corolla of short-styled flower. —E. Style of short-styled flower. —F. Undehisced capsule. A, C–E, *Cedillo T. & Torres C. 1594* (PTBG); B, *Lorence & Cedillo T. 4273* (PTBG); F, *Lorence 4009* (PTBG).

ence & R. Torres C. 4009 (holotype, MEXU, photo PTBG; isotypes, BM, F, MO, PTBG). Figures 6A–F, 7A, B.

Species *Rondeletiae jurgensenii* Hemsley affinis, caulibus foliis inflorescentiaque glabris, floribus cum lobis calycinis inaequalibus foliaceis, spathuli- vel ligulato-ellipticis, (2–)3 minoribus deltoideis vel subulatis, et fructibus minoribus, 3–5 mm longis, 2.5–3.5 mm diametro, differt.

Shrubs or small trees 2–6 m tall, the main stem to 5 cm diam., the twigs slender, 1–2(–3) mm diam., glabrous, the internodes 1.5–9 cm long. Leaves opposite, petiolate, those of a pair at a node unequal

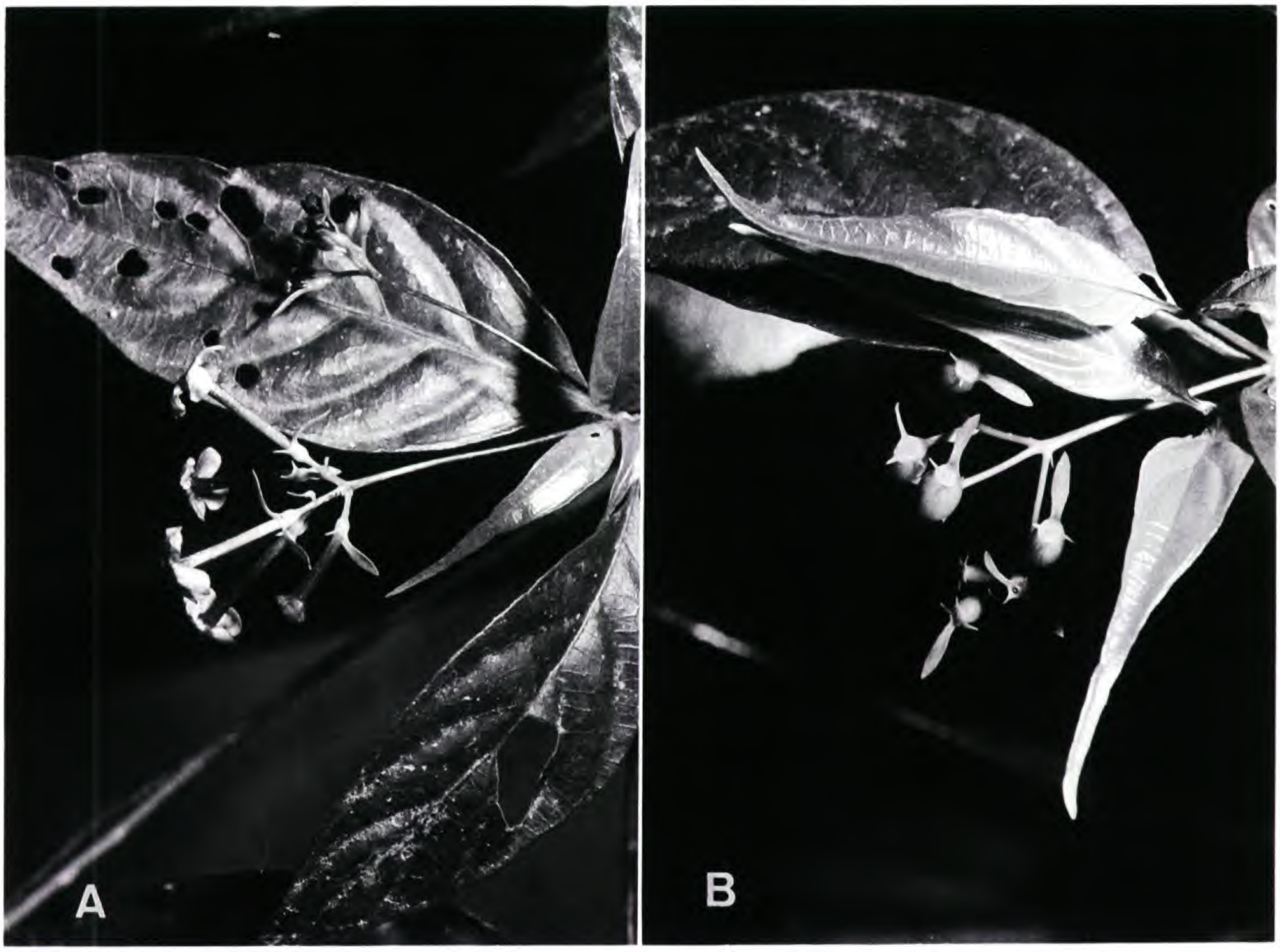

Figure 7. *Rondeletia purpurea* Lorence, growing in the Sierra de Juárez of Oaxaca, Mexico. —A. Twig with inflorescence. —B. Twig with immature fruits. *Lorence & Cedillo T. 4273* (MEXU).

or subequal; petioles 0.3–3 cm long, 0.5–1 mm diam., glabrous or with rare, scattered hairs when young; lamina ovate, narrowly ovate, or ovate-elliptic, 4–13 × 1.2–5.5 cm, drying chartaceous, discolorous, green or brown, adaxially glabrous, nitid, abaxially dull, glabrous except for rare, scattered hairs along costa, veins, and margin when young, the base cuneate, obtuse, or rounded, the apex long acuminate or caudate, the acumen 1–3 cm long, falcate, the 2° veins 4–6 pairs, strongly arcuate, festooned brochidodromous, the vein axils slightly barbate and domatiate, the venation visible to 3° on both surfaces; stipules deltoid, 1.3–2 mm long and wide basally, the apex acute or acuminate, externally glabrous, internally sericeous with white trichomes to 1 mm long. Inflorescence terminal, cymose, thyrsiform, 5–8(–14) × 3–9(–12) cm including the corollas, sessile or the peduncle 5–7 cm long, 16–40-flowered, trichotomous, the 1° branches 3, ascending, 1.5–5 cm long, subequal or the central one longest, these unbranched or branching once again, ending in 3(–5)-flowered cymules, the axes glabrous; flowers 4-merous, distylous, on slender pedicels 0.5–2 mm long, minutely bracteolate, the hypanthium ellipsoid, 1.3–1.6 × 1–1.2 mm, glabrous, the calyx cup 0.2 mm deep, the lobes sparsely strigillose externally, ciliolate, unequal, 1(–2) large and foliaceous, ligulate-elliptic or spathulate, 2.5–5 × 0.7–1 mm, apically obtuse or acute, ciliolate, the other (2–)3 lobes much smaller, deltoid or subulate, 0.5–1.2 × 0.3–0.5 mm, apically acute, each sinus with a subglobose brown colleter; corolla salverform at anthesis, when fresh uniformly dark purple or the lobes rarely light purple, the tube slender, 12–14 mm long, 1.3–1.6 mm diam. distally, externally glabrous, internally sparsely hirtellous basally, the lobes spreading, subcircular, 1.5–2.5 × 1.5–2.5 mm, externally setose with scattered hairs, internally minutely papillose between the lobes; stamens sessile, the anthers ellipsoid, 1.5 mm long, attached 1 mm below throat in short-styled flowers, 3 mm below throat in long-styled flowers; style glabrous, 7.5 mm long in short-styled flowers, 11 mm long in long-styled flowers, the 2 stigmas 1–1.5 mm long. Capsules ovoid or ellipsoid, 3–5 mm long, 2.5–3.5 mm diam., slightly bisulcate, with 8 low, lon-

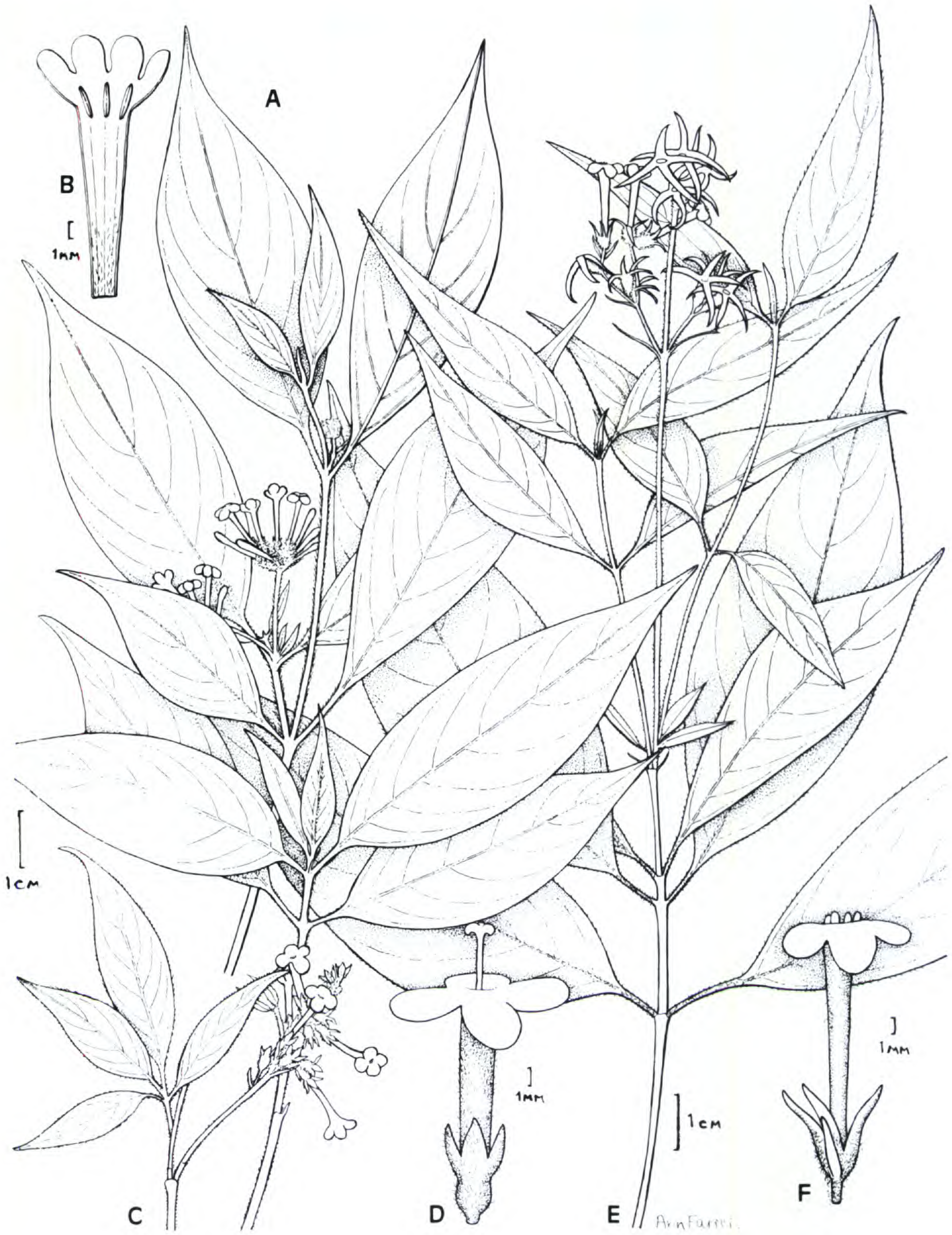

Figure 8. Three Mexican species of *Rondeletia*. A, B. *R. scoti* Lorence. —A. Habit. —B. Corolla, opened. C, D. *R. guerrerensis* Lorence. —C. Habit. —D. Detail of long-styled flower. E, F. *R. ricoi* Lorence. —E. Habit. —F. Detail of short-styled flower. A, B, *MacDougall s.n.* in 12 Mar. 1953 (PTBG); C, D, *Martínez & Barrie 5596* (PTBG); E, F, *Rico A. et al. 566* (PTBG).

gitudinal ridges, glabrous, loculicidal then septicidal; seeds subglobose, 0.4 mm diam., the testa deeply reticulate, light brown.

Distribution. This species is known only from the Sierra de Juárez in northeastern Oaxaca and from the northern highlands of Chiapas near Tila.

Habitat. Rondeletia purpurea occurs in lower montane and montane cloud forest associated with *Engelhardtia* (*Oreomunnea*) *mexicana*, *Brunellia*, *Hedyosmum*, *Liquidambar*, and Lauraceae, from about 1,100 to 1,900 m. Flowering specimens were collected from February to July and fruiting specimens from April to August.

Figure 9. —A, B. *Rondeletia ricoi* Lorence. *Rico A. et al. 566* (holotype, MEXU).

Additional specimens examined. MEXICO. OAXACA: Distrito de Ixtlán, Sierra de Juárez, Ruta 175 Tuxtepec a Oaxaca, 5 km N de Vista Hermosa, 1,175 m, *Cedillo T. & Torres C. 1594* (MEXU, PTBG), *Tenorio M. 11034* (MEXU); 1 km SE de La Esperanza, 1,600 m, *Lorence & Cedillo T. 4273* (CHAPA, MEXU, MO, PTBG, XAL); 14.9 mi. S of Valle Nacional, *Croat 48021* (MEXU, MO). CHIAPAS: Mun. de Tila, Ejido Tiontipac, camino de Tila a Salto de Agua, 1,100 m, *Calzada et al. 3324* (XAL).

Rondeletia purpurea is referable to Standley's (1918) *Calycosae* group and is most closely allied to *R. jurgensenii*, also of southern Mexico. The latter species has larger leaves, a larger inflorescence with more numerous flowers, and subequal or equal, nonfoliaceous, linear-subulate calyx lobes.

10. Rondeletia ricoi Lorence, sp. nov. TYPE: Mexico. Oaxaca: Distrito de Putla de Guerrero, a 10 km al NE de Putla, 950 m, 9 Dec. 1982, *L. Rico, E. Martínez & O. Tellez V. 566* (holotype, MEXU, photo PTBG; isotypes, BM, F, MO, PTBG). Figures 8E, F, 9A, B.

Species *Rondeletiae mexicanae* (Turcz.) Standley affinis, foliis magis sparsim pubescentibus, pagina abaxiali laminae arachnoideo-floccosa, paribus septem ad novem venarum lateralium, inflorescentia maiori 6–14 cm longa, 4–6 cm lata, floribus lobis calycinis lanceolatis vel ellipticis 5–7 mm longis, 1–1.5 mm latis, differt.

Shrubs (label says "herbacea") 0.5 m tall, the leafy twigs 1–2 mm diam., sparsely strigillose, the trichomes to 0.5 mm long, flattened and twisted, whitish, septate, glabrate, the internodes 2–5 cm long. Leaves opposite, petiolate, those of a pair at a node equal to slightly unequal; petioles 3–12 mm long, 1 mm diam., arachnoid villosulous, especially adaxially, slightly winged distally; lamina elliptic or ovate-elliptic, somewhat falcate, 5–11 × 1.5–4 cm, chartaceous, drying brownish green, slightly discolorous, adaxially with scattered hairs along costa, abaxially arachnoid flocculose, with larger hairs scattered along costa and veins, glabrate, the base acute or obtuse, the apex acuminate, the acumen 1–2 cm long, the 2° veins 7–9 pairs, acrodromous, the venation visible to 3° adaxially and to 4° abaxially, the margin thin, ciliolate; stipules narrowly subulate-acuminate, 3–7 × 1–2.5 mm basally, dorsally carinate, externally glabrous, internally densely villous.

Figure 10. *Rondeletia rzedowskii* Lorence. *Laboratorio de Biogeografía 867* (holotype, MEXU).

Inflorescence terminal, 6–14 × 4–6 cm including the corollas, thyrsoid-pleiochasial, broadest basally, 16–36-flowered, the peduncle 2.5–8.5 cm long, 1 mm diam., villosulous, the 1° branches 2–3 pairs, the basal pair the longest, ascending at a 45° angle, unbranched or bifurcate, the ultimate branches terminated by monochasia of 3–5 flowers, the upper 1° branches smaller, opposite or alternate, few-flowered, the axes white villosulous, bracteolate, the bracteoles linear, to 1 cm × 1 mm; flowers 4-merous, distylous, subsessile or on pedicels 1–2 mm long, the hypanthium subglobose or ellipsoid, 2 × 1.5 mm, densely white villous or tomentose, the calyx cup 0.6–0.7 mm deep, the lobes externally densely villous, internally glabrous, equal or subequal, lanceolate or narrowly elliptic, 5–7 × 1–1.5 mm basally, each sinus with 1–3 reddish brown, ellipsoid colleters; corolla white when fresh, salverform at anthesis, the tube 11–12 mm long, 1 mm diam. medially, externally villous with long, white hairs in distal ½–⅔, internally glabrous, the lobes spreading, broadly obovate, 2.5–3 × 2 mm, obtuse, externally densely villous-sericeous with long, white hairs, internally glabrous; stamens in short-styled flowers sessile, the anthers ellipsoid, 2 mm long, attached just below throat, the tips exserted; style in short-styled flowers included, 5.5 mm long, glabrous, the 2 ellipsoid stigmas 1.5 mm long. Immature capsule subglobose, 4 mm diam.; seeds unknown.

Distribution. Rondeletia ricoi is known only from the type locality in the vicinity of Putla de Guerrero in the Sierra Madre del Sur of Oaxaca near the border with Guerrero, Mexico.

Habitat. The species was collected in disturbed vegetation adjacent to a mesic *Quercus* forest at about 950 m.

Rondeletia ricoi keys out to Standley's (1918) *Leucophyllae* group because of the arachnoid pubescence on the abaxial leaf surface. This species is closely related to *R. mexicana*, which differs in having ferrugineous pubescence, recurved leaves with a subcordate base and the abaxial surface densely whitish tomentose, more numerous secondary veins (11–12 pairs), longer, ovate stipules, a more elongate, narrower inflorescence to 20 cm long, and flowers with narrower, linear-subulate calyx lobes. I take pleasure in naming this new species for its collector, María de Lourdes Rico Arce, formerly of the Herbario Nacional, Instituto de Biología, U.N.A.M.

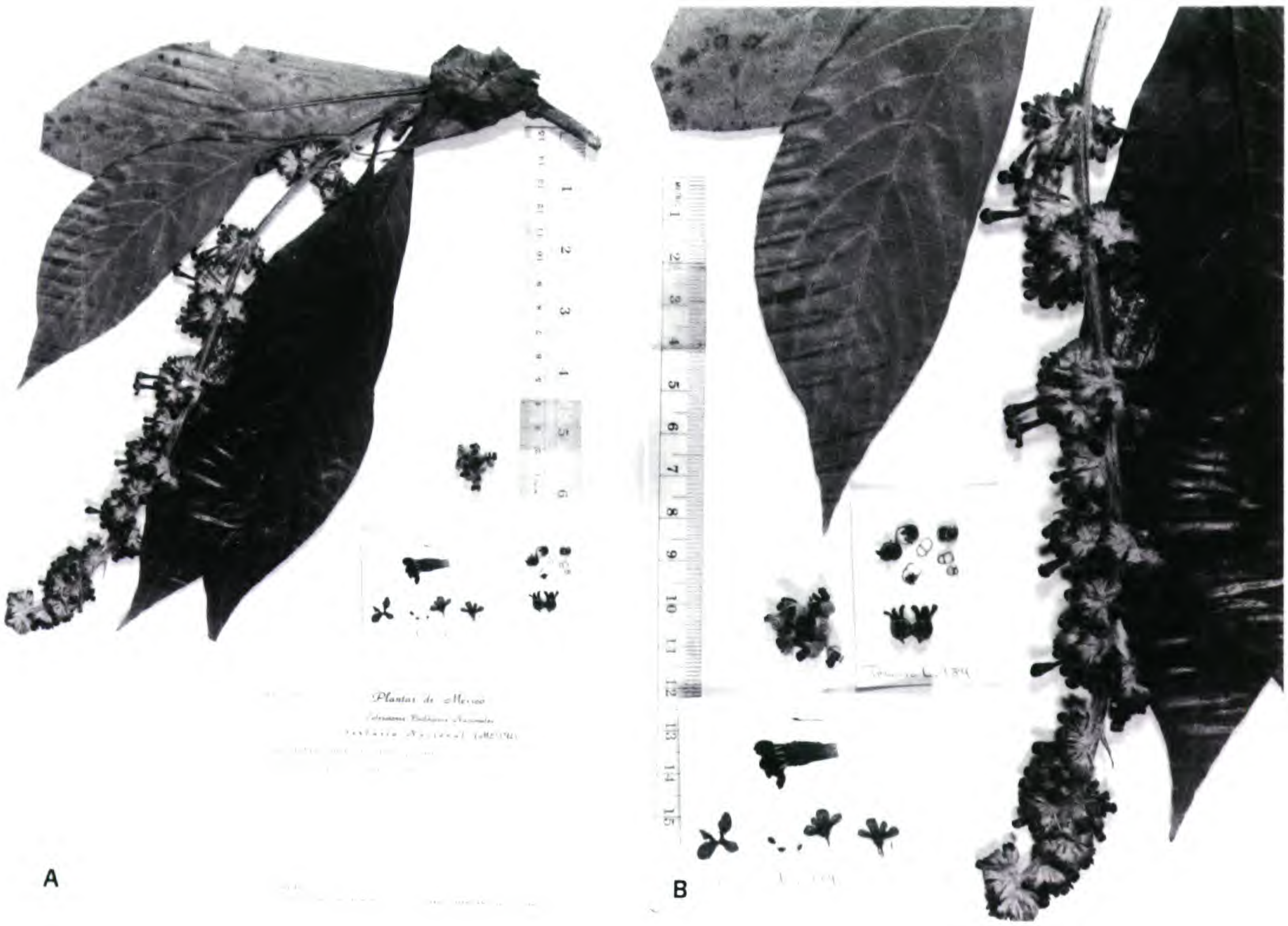

Figure 11. —A, B. *Rondeletia tenorioi* Lorence. *Tenorio L. & Torres C. 184* (holotype, MEXU).

11. Rondeletia rzedowskii Lorence, sp. nov. TYPE: Mexico. Guerrero: Municipio de Atoyac, Pto. de la Piedra Acanalada, 1,930 m, 6 ene. 1984, *Laboratorio de Biogeografía 867* (holotype, MEXU, photo PTBG; isotypes, FCME, MEXU). Figure 10.

Species *Rondeletiae guerrerensis* Lorence affinis, inflorescentia breviori latiori sessili corymbosa trichotoma 6–7 cm longa 7–8 cm lata, floribus 41–47, corolla lobis brevioribus 2–3 mm longis 2–2.5 mm latis differt.

Small trees to 6 m tall, the young twigs densely strigillose, the trichomes fulvous or rufous, 0.3–0.4 mm long, flattened, twisted, persistent, the leafy twigs 1.5–2 mm diam. Leaves opposite, petiolate, those of a pair at a node subequal or unequal, one up to 50% larger than the other; petioles 1–2.5 cm long, 0.8–1 mm diam., densely rufous strigillose; lamina elliptic, 7–11 × 3.2–4 cm, chartaceous, drying dark green, discolorous, adaxially strigillose, the hairs denser on costa and veins, abaxially strigillose on costa and veins, costa also with spreading hairs, the 2° vein axils barbate, the base cuneate, rarely attenuate, the sides equal to slightly unequal, the apex acuminate or caudate, the acumen 1–2 cm long, often falcate, the 2° veins 7–8 pairs, acrodromous, the venation visible to 3° adaxially and to 4° abaxially, the margin thin, callose; stipules narrowly triangular, erect, 2–3 mm long. Inflorescence terminal, sessile, cymose-corymbiform or pleiochasial, 6–7 cm × 7–8 cm including the corollas, 41–47-flowered, branching to the 3°, the axes densely rufous strigillose, trichotomous, the 1° branches 2.5–3.5 cm long, these branching twice again dichasially, the ultimate branches with cymules of 2–5 flowers; flowers 4-merous, sessile or on densely strigillose pedicels to 1.5 mm long, the hypanthium turbinate-cylindrical, 1–1.5 × 0.9–1.2 mm, densely rufous strigillose-villous, the calyx cup 0.3–0.4 mm deep, externally strigillose, the calyx lobes strigillose on both surfaces, unequal, 1 large and foliaceous, elliptic or ligulate, 3–3.5 × 1–1.5 mm, green, the other 3 smaller, narrowly triangular or subulate, 0.5–0.6 × 0.3–0.4 mm, each sinus with a single brown colleter; corolla white when fresh, salverform at anthesis, the tube 12–16 mm long, 0.8–1 mm diam. medially, externally villous-strigillose, densely so basally, internally hirtellous in basal ⅓, with a small, villous-hirtellous ring at base, the throat glabrous, the lobes spreading, broadly obovate or ellip-

tic, 2–3 × 2–2.5 mm, obtuse, the margin entire, externally strigillose basally, internally glabrous; stamens in short-styled flowers sessile, not exserted, attached 2.5 mm below throat, the anthers ellipsoid, 3.5–4 mm long; style in short-styled flowers included, 5–6 mm long, glabrous, the 2 linear-ellipsoid stigmas 2 mm long, the disc sparsely pilose. Capsules and seeds not seen.

Distribution. Rondeletia rzedowskii is known only from the type locality in the Sierra Madre del Sur of Guerrero, Mexico.

Habitat. This species occurs in montane cloud forest at 1,930 m, where it was collected in a humid canyon associated with *Cyathea.* The type was flowering in January.

Rondeletia rzedowskii keys out to the *Calycosae* group of Standley (1918). It is closely allied to *R. guerrerensis* (Fig. 8C, D), which differs in having leaves that are loosely white arachnoid tomentose beneath, a narrower and more elongate inflorescence with flowers in subsessile or shortly pedunculate cymes, and flowers with a dense white tomentum on the outer surface of the calyx lobes and corolla tube. I am pleased to name this species for Jerzy Rzedowski, one of Mexico's most prolific botanists, who has contributed greatly to our knowledge of the systematics and ecology of the rich and fascinating Mexican flora.

12. Rondeletia scoti Lorence, sp. nov. TYPE: Mexico. Oaxaca: La Glorieta–Río Grande (N slope), flowers white, shrub ± 6 ft., *T. MacDougall s.n.* in 12 Mar. 1953 (holotype, MEXU, photo PTBG; isotypes, PTBG–2 sheets). Figure 8A, B.

Species *Rondeletiae atravesadensis* Lorence affinis, sed foliis maioribus 3.5–7.5 × 1.3–2.7 cm, nervis secondariis in axillis domatiis barbatis instructi, inflorescentia floribusque dense fulvostrigosis, floribus sessilibus, calycis lobis latioribus ligulato-ellipticis vel oblanceolatis, 2–3.5 × 1–1.5 mm differt.

Shrub ca. 1.8 m tall, the leafy twigs 1–1.5 mm diam., cylindrical, densely strigillose to short strigose when young, glabrate in age, the trichomes setose, 0.4–0.6 mm long, ascending, pale grayish yellow or fulvous, the internodes 0.5–6.5 cm long. Leaves of a pair at a node subequal or unequal; petioles of a pair subequal or unequal, 5–13 mm long, 0.6–0.8 mm diam., densely strigillose to short strigose; lamina elliptic, 3.5–7.5 × 1.3–2.7 cm, thickly chartaceous, drying discolorous, brown, adaxially strigillose-scabrid when young, the trichomes short, thick, persistent or at least the raised bases persisting, longer and more persistent along costa and 2° veins, abaxially scattered strigillose to short strigose, densely so along costa and 2° veins, the base cuneate or narrowly cuneate, the apex acuminate, the acumen 8–12 mm long, the 2° veins 5(–6) pairs, acrodromous, the axils with barbate domatia, the venation visible to 2° adaxially and to 3° abaxially, the margin ciliolate; stipules narrowly triangular, 1.5–2 × 1–1.5 mm basally, thick, erect, both surfaces densely strigillose, internally with several dark brown, digitate colleters 0.3–0.5 mm long near base. Inflorescence terminal, 2.5–3.5 × 2–3 cm including the corollas, corymbiform, 12–15(–21)-flowered, trichotomous, subsessile, the peduncle 2–4 mm long, the axes densely fulvous strigillose to short strigose, the 1° branches 8–15 mm long, subequal or the middle branch slightly longer, each ending in a capitulum of 3–5(–12) flowers composed of 1–3 cymules, the cymules subtended by several subulate to ligulate or spathulate bracteoles 1–4 mm long; flowers 4-merous, sessile, the hypanthium obconical, 1.5 × 1–1.2 mm, densely fulvous strigillose, the calyx cup 0.2 mm deep, the lobes subequal, erect, ligulate-elliptic or oblanceolate, 2–3.5 × (0.5–)1–1.5 mm, the apex acute to rounded, externally densely strigillose, internally sparsely strigillose, each sinus with 2–3 short, brown digitate colleters; corolla white when fresh, at anthesis salverform, the tube 9–11 mm long, 0.8 mm diam. medially, externally densely strigillose, internally sparsely hirtellous in basal 3–4 mm, the lobes spreading, broadly obovate or subcircular, 3–4 × 2–3 mm, externally strigillose or short strigose, internally sparsely barbate around throat with short, broad, white, septate trichomes, the margins subentire or erose-crenulate; stamens sessile, affixed 1.5 mm below throat in short-styled flowers, the anthers linear-ellipsoid, 1.7–1.8 mm long, included; style included in short-styled flowers, 4–5 mm long, the 2 linear stigmas 3 mm long, the disc 0.5 mm diam., densely white hirtellous. Capsules and seeds not seen.

Distribution. Rondeletia scoti is known only from the type locality, which is actually La Gloria, not "La Glorieta" as erroneously stated on the label. La Gloria is situated at the boundary of the Municipio of Santa María Chimalapa along the northern part of the Municipio of San Miguel Chimalapa in the Juchitán District of Oaxaca (P. Dávila Aranda, pers. comm.). This was a favorite collecting locality of MacDougall during his annual visits to Mexico. The type collection was flowering in March, but the label data do not specify the habitat or elevation.

Rondeletia scoti is referable to the *Calycosae* group of Standley (1918) and is closely allied to *R.*

atravesadensis. The latter species differs by its less densely strigillose stems and leaves with more slender hairs, shorter leaves with fewer (3–4 pairs) secondary veins that lack domatia, hirtellous or hirsutulous inflorescence axes, and subsessile or shortly pedicellate flowers with much narrower triangular or subulate calyx lobes. The specific epithet is the genitive of *scotus*, a person of Scottish ancestry. This species commemorates Thomas Baille MacDougall, intrepid botanical explorer of Scottish birth.

13. Rondeletia tenorioi Lorence, sp. nov. TYPE: Mexico. Oaxaca: Distrito de Juxtlahuaca, 19 km al SW de Juxtlahuaca y a 5 km en la misma dirección de Sta. Ma. Asunción, 1,900 m, 4 abr. 1982, *P. Tenorio & R. Torres C. 184* (holotype, MEXU, photo PTBG; isotypes, BM, F, MO). Figure 11A, B.

Species *Rondeletiae tacanensis* Lundell affinis, a qua pubescentia caulis petiolorumque alba sericeo-villosa, stipulis grandioribus ovato-acuminatis foliaceis 12–18 mm longis, 8–12 mm latis, foliis nitidis fere glabris, inflorescentia erecta ramis primariis brevioribus subsessilibus usque ad 5 mm longis differt.

Trees 2–4 m tall, the leafy twigs stout, 7–9 mm diam., densely sericeous-villous when young with matted, white trichomes to 1 mm long, the internodes often compressed, 2–8 cm long. Leaves of a pair at a node subequal or one somewhat larger, petiolate; petioles of a pair subequal, 1.5–6 cm long, 1–2 mm diam., densely villous-sericeous; lamina elliptic, 9.5–25 × 2.7–8 cm, drying discolorous, brownish green, adaxially nitid, glabrous except for scattered hairs along the costa, abaxially sericeous-villous, the base narrowly cuneate, the apex acuminate, the acumen 1–2 cm long, the 2° veins 9–17 pairs, acrodromous, the venation visible to 4° on both surfaces, the margin callose; stipules somewhat spreading, broadly ovate-acuminate, foliaceous, 12–18 × 8–12 mm, externally densely strigose-sericeous, internally densely sericeous, the trichomes mixed with numerous dark brown, digitate colleters 1–1.5 mm long, the margins revolute. Inflorescence terminal, narrowly thyrsiform-cymose, 29–33 × 4–5 cm medially, the peduncle quadrangular, 2.5–7 cm long, 4–5 mm diam., the axes densely sericeous-villous, the 1° branches 9–11 pairs, opposite or subopposite, subsessile or to 5 mm long, the basal pair subtended by a pair of reduced leaves and a pair of stipules, the upper 1° branches usually branched once, subtended by thin, brown, dorsally sericeous, linear or lanceolate bracts up to 2 cm long, the ultimate branches ending in cymules of 5–15 flowers; flowers 4-merous, subsessile or on densely villous pedicels 1–2 mm long, the hypanthium subglobose or turbinate, 2 × 2 mm, densely white tomentose-villous, the calyx externally densely white sericeous-villous, internally glabrous, the cup 0.6–0.7 mm deep, the lobes subequal or slightly unequal, obovate or ligulate, 3–4 mm × 1.5–3 mm, venose, the apex obtuse, truncate, or emarginate; corolla red when fresh, at anthesis salverform, the tube 12–14 mm long, 1 mm diam. medially, dilated to 2 mm distally, externally strigillose-villous, especially distally, internally hirtellous in basal half with a hirtellous ring basally, the lobes spreading 90°, suborbicular, obtuse, 2 × 3 mm; stamens in short-styled flowers sessile, the anthers attached just below throat, ellipsoid, 2.5 mm long; style in short-styled flowers included, 6 mm long, the ellipsoid stigmas 2 mm long, the disc annular, 0.7 mm diam. Immature fruits subglobose, 5 mm diam., externally villous, the calyx lobes persistent; immature seeds 0.7–0.8 × 0.5–0.6 mm, the testa light brown, reticulate.

Distribution. Rondeletia tenorioi is known only from the type locality in the Mixteca Alta of western Oaxaca near the Guerrero border.

Habitat. This species was collected in secondary vegetation derived from cloud forest at 1,900 m. Flowers and immature fruits were collected in April.

Rondeletia tenorioi is a distinctive species referable to the *Laniflorae* group of Standley (1918) on the basis of its narrow, elongate inflorescence. It appears to be most closely related to *R. tacanensis* of Chiapas and Guatemala, a species differing by its shorter and sparser rufous velutinous pubescence, smaller and narrower nonfoliaceous stipules 5–9 mm long, adaxially dull, hirtellous leaves, reflexed inflorescence with longer primary branches, and subulate-lanceolate, apically acute calyx lobes. I take pleasure in naming this species for Pedro Tenorio, collector for the Herbario Nacional of the Instituto de Biología, U.N.A.M.

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Orchidaceae Dunstervillorum II. *Maxillaria cryptobulbon* sp. nov. and a Note on the *Maxillaria brunnea* Complex

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Maxillaria cryptobulbon Carnevali & J. T. Atwood, sp. nov. TYPE: Ecuador. Morona-Santiago: Serranía de Cutucú, 25 km SE of Logroño, flowering at the Marie Selby Botanical Gardens, 6–10 Jan. 1991, *J. D. Ackerman 1041*, accession number SEL 76-0023-068-EC, based on *Madison s.n.* (holotype, SEL; isotypes, MO, VEN). Figures 1, 2.

Species haec *M. brunneae* Linden & Reichb. f. affinis sed pseudobulbis multiminoribus vaginis scariosis straminеis omnino occultis, pseudobulbi vaginis vulgo non foliaceis vel raro limbo munitis; foliis latioribus ellipticis vel late ellipticis, longe petiolatis; sepalis rubro-brunneis, petalis interne aurantiacis vel roseis, externe rubro-brunneis; labello angustiore, lobo apicali ovato vel oblongo-lanceolato, proportione longiore, callo elliptico angustiore, conspicue excavato recedit.

Epiphytic or rarely muscicolous, caespitose herbs 30–50 cm tall. Rhizome very abbreviated; pseudobulbs 0.8–1.2 cm long, 0.9–1.5 cm wide, apically 1-leaved, transversely ellipsoid to suborbicular, or rarely oblong, ± laterally compressed, clothed by several sheaths; sheaths broad, imbricate, pale cream-brown or very clear white, shiny, papery in dried specimens, persisting on mature pseudobulbs and disintegrating in older ones, sometimes the uppermost with foliar blade. Leaves and the blades of the sheaths (20–)25–35(–42) cm long, (2.3–)4.5–7 cm wide, long-petioled; blades elliptic to broadly elliptic, acute, somewhat decurved in natural position, underside often somewhat glaucous; petioles (4–)8–15(–24) cm long, (⅛–)⅓–½(–⅔) the length of the blade, laterally compressed, channeled in the apical half, becoming subterete in the lower half. Inflorescences 8–15 cm long, usually about ½ the length of the petiole, rarely longer, 1-flowered, 1–3 originating simultaneously from the flush of the new growth; peduncle subterete, erect to subhorizontal, almost completely clothed by 4–6 subinflated, tubular sheaths; sheaths 2–3.3 cm long, dull dark red-purple with a green apex when fresh, drying pale dull brown. Floral bracts 23–26 mm long, 14–16 mm wide, elliptic to oblanceolate, obtuse, mucronulate. Ovary with pedicel 30–33 mm long, terete, verruculose. Flowers resupinate, horizontally patent, lasting 4–6 days on the plant; sepals dark dull red-brown or bright maroon-red, petals pink or yellow-orange within, tinged with dull red-brown without, labellum yellow-cream with bright yellow callus, the underside of the central lobe very dark red-purple. Sepals 26–28 mm long, 6–7.5 mm wide, oblong or oblong-lanceolate, apex obtuse to rounded; dorsal sepal concave and ± hooded over the column; the laterals ± oblique; petals 22–25 mm long, 5–6 mm

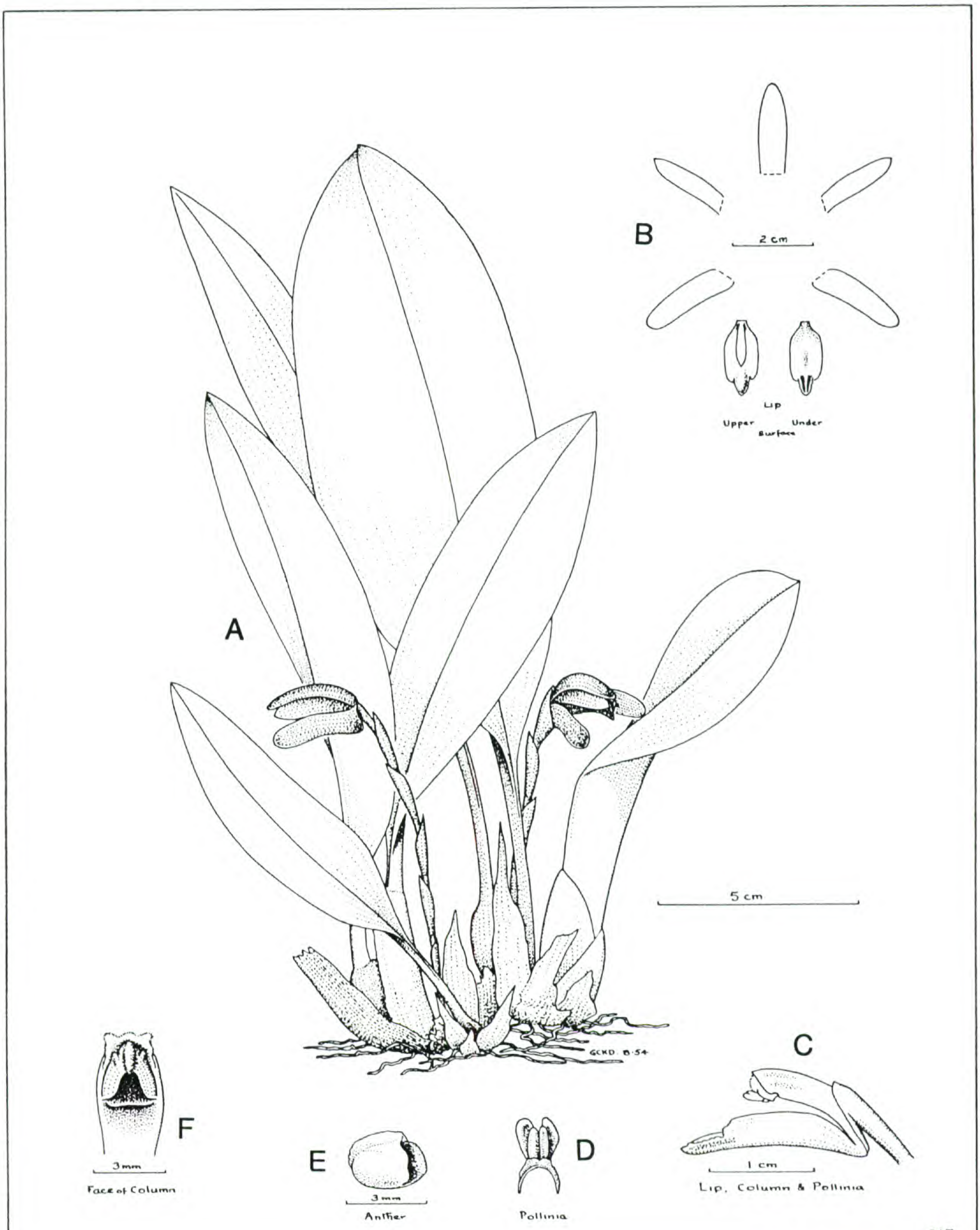

Figure 1. *Maxillaria cryptobulbon.* —A. Flowering habit. —B. Perianth segments, flattened. —C. Lateral view of labellum and column. —D. Pollinaria, ventral view. —E. Anther, lateral view. —F. Column, apical half, ventral view. (Based on *Dunsterville & Dunsterville 217.*)

wide, obliquely oblong-lanceolate, acute to obtuse, fleshier in the apical half in fresh material. Labellum 3-lobed in the apical ¼, 16–18 mm long, 8–9 mm wide between the spread apices of the lateral lobes, oblong or oblanceolate; lateral lobes erect and partially surrounding the column in natural position, apices erose or crenate, rounded or subtruncate; central lobe 4.5–5.5 mm long, ca. 4 mm wide,

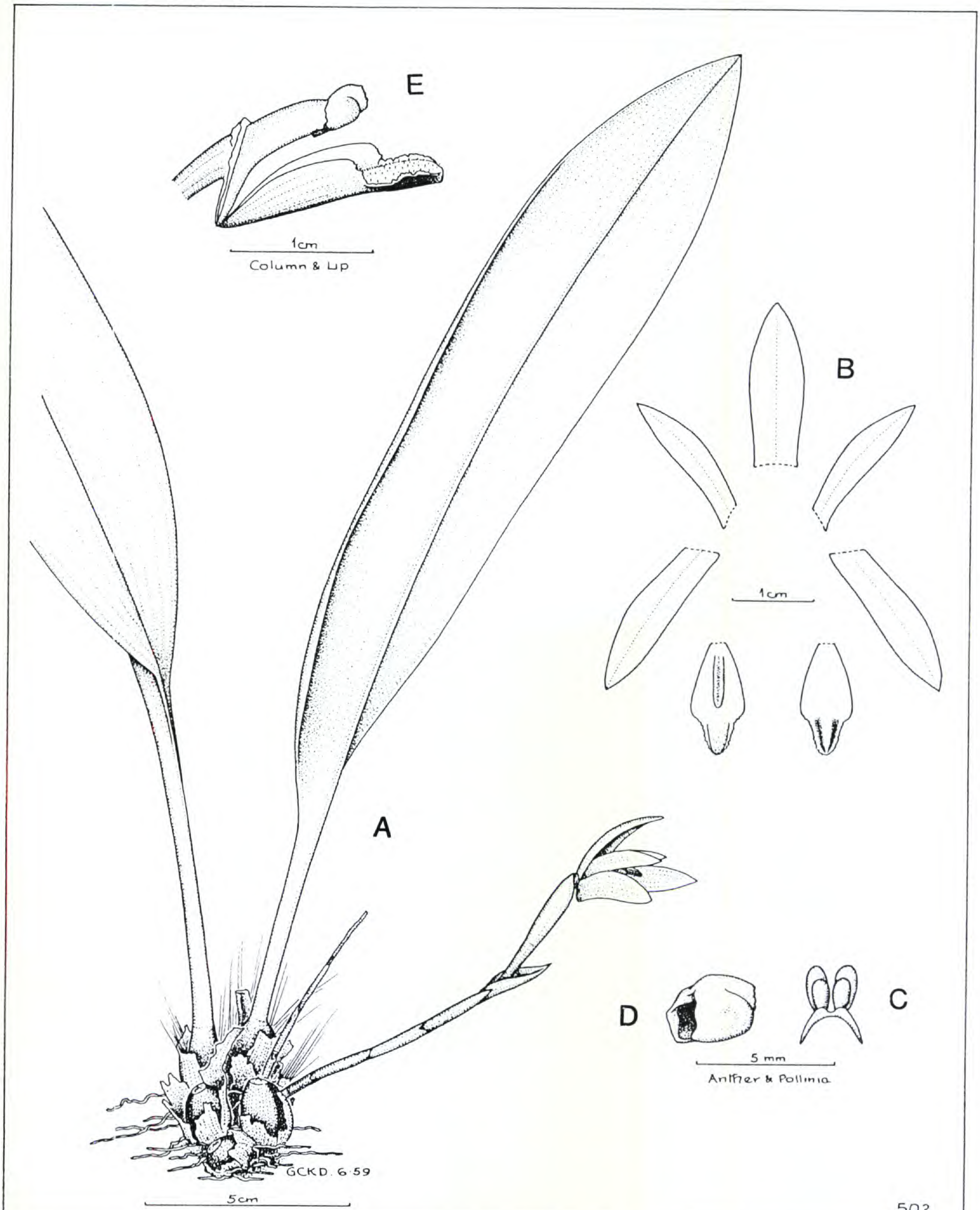

Figure 2. *Maxillaria cryptobulbon.* —A. Flowering habit. —B. Perianth segments, flattened. —C. Pollinaria, ventral view. —D. Anther, lateral view. —E. Column and labellum, lateral view. (Based on *Dunsterville & Dunsterville 502.*)

oblong to ovate-oblong, obtuse, thickened and fleshy, keeled without, margins surrounded by an undulate, suberect, rigid membrane ca. 0.5 mm wide, ventral face subrugulose; disk smooth, provided with a well-developed callus; callus 9–10 mm long, ca. 2 mm wide, narrowly elliptic, acute, glabrous except for the apical ⅓, deeply channeled longitudinally; the whole blade laxly covered by a pubescence com-

posed of 0.1-mm-long, 2–3-cellular, fusiform or clavate hairs, pubescence is denser on the central lobe and on the apical margins of the callus. Column 7–9 mm long, 2.5–3 mm thick, hemicylindric, smooth, ventrally with a longitudinal, low, medial keel, basally with a well-developed foot 4–4.5 mm long at 45°–75° angle; clinandrium microscopically erose; anther dorsally keeled, keel smooth.

Paratypes. COSTA RICA. CARTAGO: along Camino Raíz de Hule, SE of Platanito (Tsiripi), 1,200–1,400 m, 1 July 1976, *Croat 36769* (MO, SEL). ECUADOR. CARCHI: El Pailón, ca. 45 km below Maldonado, wet montane forest, 800 m, 27 Nov. 1979, *Madison & Besse 7064* (SEL). NAPO–PASTAZA: near Puyo, 13 Oct. 1961, *Dodson & Thien 951* (MO, SEL); near Tena, 450 m, 26 Feb. 1963, *Dodson & Thien 2319* (MO, SEL); along road from Cotundo to Hollín–Coca, 1,100 m, 31 Apr. 1987, *Dodson et al. 17087* (MO); near Lumbaqui in road Baeza to Lago Agrio, 800 m, 7 Feb. 1989, *Dodson & Embree 18147* (MO); Bermejo Oil Fields, 800–1,000 m, 9 Feb. 1986, *Hirtz et al. 2710* (MO); Río Pastaza below Río Negro, 1,500 m, 18 Mar. 1976, *Luer, Luer & Taylor 892* (SEL); Topo, at junction of Río Topo and Río Pastaza, 1,300 m, 10 Dec. 1986, *Dodson & Hagsater 16748* (MO, SEL); E of Río Topo bridge, 1,200–1,300 m, 23 Mar. 1939, *Penland & Summers 253* (AMES). TUNGURAHUA: Río Mapoto, confluence with Pastaza, 1,200–1,300, 21 Mar. 1939, *Penland & Summers 206* (AMES); Río Ulba above power station E of Baños, 22 Feb. 1963, *Dodson & Thien 2300* (MO, SEL); Río Verde, 21 Apr. 1971, *Holguer Lugo 1775* (AMES); Cashurco, near Río Negro, N side of Río Pastaza, 18 Mar. 1969, *Holguer Lugo 803* (AMES). VENEZUELA. BOLÍVAR: La Escalera, 107–118 km al S de El Dorado, 5°50′N, 61°30′W, 500 m, 2 Apr. 1985, *Holst, Steyermark & Manara 2076* (VEN). MIRANDA: Parque Nacional Guatopo, ca. 15 km SO de Caucagua vía Los Alpes, ca. 650 m, 20 July 1985, *Carnevali, Casaudoumecq & Sanoja 1979* (VEN); Guatopo, ca. 600 m, *Dunsterville & Dunsterville 217* (AMES), *Dunsterville & Dunsterville 502* (AMES).

Maxillaria cryptobulbon is closely related to *M. brunnea* Linden & Reichb. f., *M. amazonica* Schltr., *M. powelli* Schltr., and some other closely related species in the *Maxillaria brunnea* complex. From them, *Maxillaria cryptobulbon* is clearly distinguishable by: its broadly elliptic, long-petioled blades; occasionally having foliaceous sheaths; the narrowly elliptic, deeply sulcate callus (obtrullate, shallowly concave in *M. brunnea*) that is glabrous with the exception of the margins at the apical ⅓; and the oblong or lanceolate, obtuse central lobe of the labellum. The labellum is also longer and proportionally narrower. The coloration of the flowers is distinctive as well: while most of the flowers in the *Maxillaria brunnea* complex have yellow, yellow-cream, yellow-pink to orange sepals and petals, in *M. cryptobulbon* they are dark dull brown-red or bright maroon-red. Vegetatively, *Maxillaria cryptobulbon* resembles somewhat *M. perryae* Dodson from Ecuador, but the plant and flowers are smaller, and the labellum is narrower in the former. The name, *M. cryptobulbon*, refers to the relatively small pseudobulbs hidden by the sheaths.

This species has been frequently misidentified in herbaria as *M. brunnea* because of the superficial similarity of the flowers. Illustrations of *Maxillaria cryptobulbon* have been published twice by Dunsterville & Garay in their series *Venezuelan Orchids Illustrated*, once as *Maxillaria brunnea* (*Dunsterville & Dunsterville 217*, AMES, VEN; Dunsterville & Garay, 1959: 220), and again as *M. trinitatis* Ames (*Dunsterville & Dunsterville 502*, AMES; Dunsterville & Garay, 1961: 223). These two illustrations, which we reproduce here, clearly depict the variability of the species. Most of the specimens seen resemble vegetatively plate #502, which lacks the foliaceous sheaths, but the flowers are most similar to plate #217. The type of *M. cryptobulbon* (*Madison s.n.*) is an almost perfect match to plate #217, but some of the pseudobulbs lack the foliaceous sheaths.

Maxillaria cryptobulbon is a species of premontane rain or cloud forests at 450–1,500 m elevation. It seems to occur in shadier positions than other members of the *M. brunnea* complex, which may explain the broad leaves and foliaceous sheaths. It remains to be established whether the presence of foliaceous sheaths is genetically fixed or is a plastic response to environmental factors such as light intensity and humidity.

A NOTE ON THE *MAXILLARIA BRUNNEA* COMPLEX

The *Maxillaria brunnea* complex consists of several closely related species. The type of *Maxillaria brunnea* Linden & Reichb. f. (*Funk & Schlim 1161*, W) comes from Colombia, Norte de Santander: Ocaña, 7,000′, and is a fragmentary specimen depicting only a leaf (apparently cut above the petiole) and a solitary flower. Hence, some characters of much importance in this complex are wanting (e.g., presence vs. absence of foliaceous sheaths, petiole length, shape and size of the pseudobulbs). However, material of the complex coming from near the type locality is clearly what is being called under this name and is characterized by nonfoliaceous sheaths to the pseudobulbs (very rarely the uppermost with a foliar blade), linear-oblong foliar blades, oblong, obtuse to rounded or rarely subacute sepals, 2.5–3.2 cm long, that are dull to bright yellow often with some dull maroon or purplish flush without, cream labellum, sometimes with dull purple streaks and a band or spot of very dark red-purple on the underside of the mid-lobe and apex of the lateral

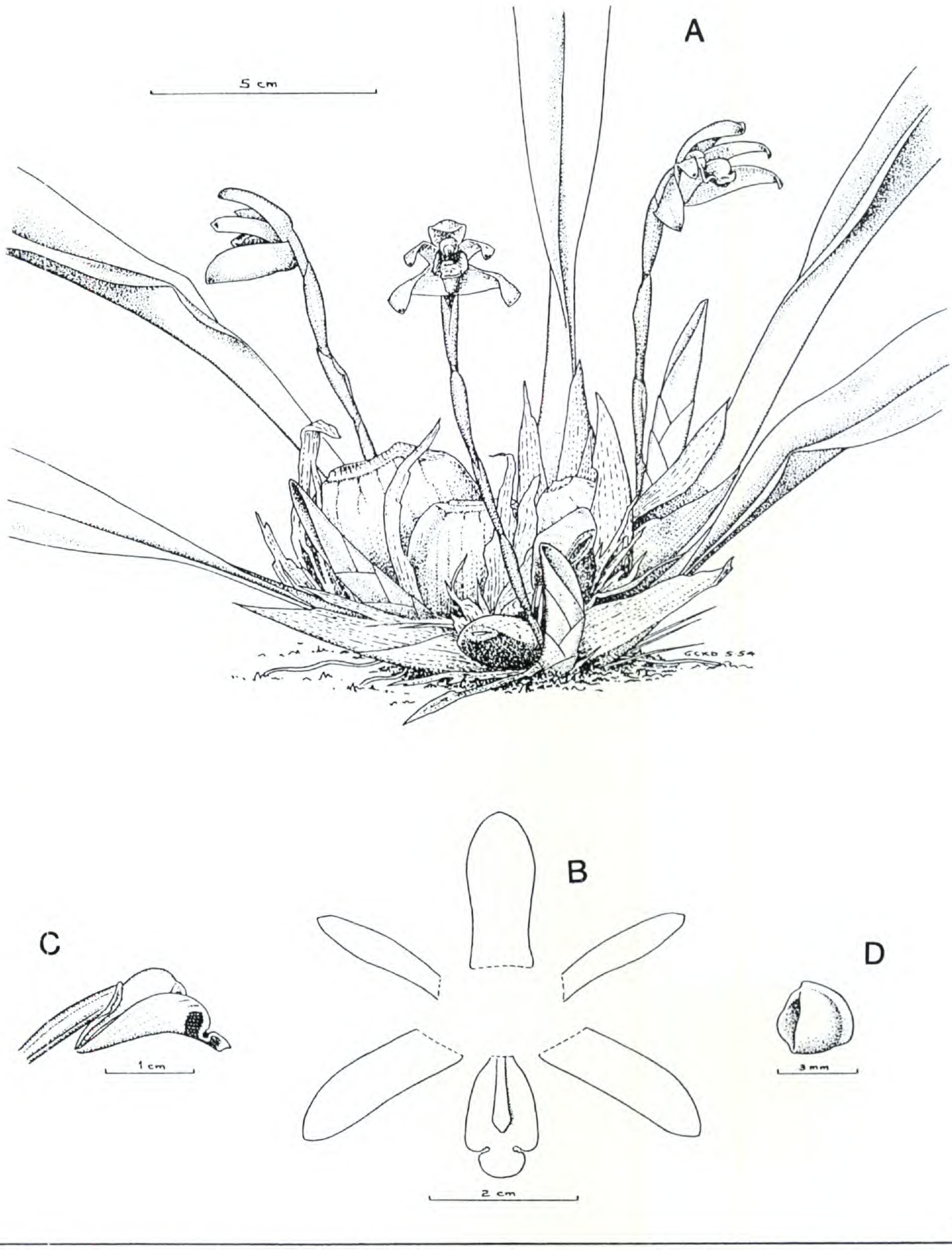

Figure 3. *Maxillaria brunnea.* —A. Flowering habit. —B. Perianth segments, flattened. —C. Column and labellum, lateral view. —D. Anther, lateral view. (Based on *Dunsterville & Dunsterville 197.*)

lobes. The species is widespread in the Neotropics at 900–1,800 m and is variable in size and details of the coloration of the flowers, as well as in the length of the inflorescence, but the variation seems not to show any correlation and we prefer to treat this group as a polymorphic species. However, many of the names usually considered to be synonyms of *M. brunnea* are either distinct species or synonyms of other species, especially of *Maxillaria ringens* Reichb. f. *Maxillaria amazonica* and *M. powelli* are very close to *M. brunnea*, but the flowers are consistently smaller with sepals 1.6–2 cm long.

Maxillaria amazonica is known from Amazonian Brazil and Guyana and is restricted to elevations of 150–400 m while *M. powelli* occurs in Panama and western Colombia at elevations of 100–1,500 m.

The several species in this complex described from Brazil, mostly by Barbosa Rodrigues, merit careful study as most of them seem to be conspecific with *Maxillaria brunnea*. This group includes *Maxillaria leucaimata* Barb. Rodr., *Maxillaria porrecta* Lindley, *M. xanthosia* Barb. Rodr., and *M. yauaperyensis* Barb. Rodr.

The name *Maxillaria ringens* has been applied to *M. brunnea* or members of the *M. brunnea* complex several times (Schweinfurth, 1960; 726; Dunsterville & Garay, 1961: 217) or has been considered to be a synonym of the latter (Foldats, 1970: 427). Several descriptions in floras and other treatments are mixtures of characters of species of the *M. brunnea* complex and species of the *M. ringens* complex (Allen, 1949: 463; Foldats, 1970: 427). Species of the *Maxillaria ringens* complex are characterized by narrowly elliptic or narrowly oblong-elliptic, acuminate sepals, which tend to be white or pale cream to pale yellowish; the peduncles of the inflorescences tend to be shorter than the petiole of the leaf; usually several flowers are produced simultaneously from the same pseudobulb. The group occurs chiefly in Central America, with only *Maxillaria taracuana* Schltr. and *M. lactiflora* Pabst (syn. *M. lactea* Schltr.) in South America and restricted there to Amazonian Brazil and Venezuela. The systematics of the species close to *M. ringens* in Central America is still unclear, but the following belong in this group: *M. amparoana* Schltr., *M. brenesii* Schltr., *M. pubilabia* Schltr., *M. rousseauae* Schltr., and *M. tuerckheimii* Schltr.

Figure 3 is one of several plates by G. C. K. Dunsterville featuring *Maxillaria brunnea*. This particular illustration was published in *Venezuelan Orchids Illustrated* 2: 199, 1961, as *M. amazonica* Schltr. Additional iconography depicting our interpretation of *Maxillaria brunnea* is to be found in *Venezuelan Orchids Illustrated* 2: 217, 1961, (as *M. ringens* Reichb. f.); *Icones Plantarum Tropicarum* 1(2): 147, 1980; 1(11): 1044, 1984; 2(3): 252, 1990; *Flora de Venezuela* 15(4): 411, 1970 (as *M. amazonica* Schltr.).

The following selected specimens of *Maxillaria brunnea* show some of the geographic and morphological variation of our concept of the species.

COSTA RICA. ALAJUELA: Monteverde Reserve, Peñas Blancas river valley, 10°18′N, 84°45′W, 900–1,150 m, 29 Oct. 1986, *Haber ex Bello 6147* (MO). ECUADOR. EL ORO: new road Santa Rosa to Loja, 830 m, 20 Mar. 1985, *Luer et al. 10691* (MO). PASTAZA: Km 10 on road from Mera to Río Anzu, 1,400 m, 30 May 1986, *Dodson & Dodson 16493* (MO). VENEZUELA. BOLÍVAR:Depto. Piar, Salto Aicha near eastern base of Uaipán-tepui, 62°32′W, 5°38′N, ca. 1,100 m, 27–28 Nov. 1982, *Davidse & Huber 22830* (MO, VEN). TÁCHIRA: Río San Buena, 10 km E of La Fundación, 700–1,000 m, 7°47–48′N, 71°46–47′W, 13–15 Mar. 1980, *Liesner et al. 9665* (MO, VEN).

Maxillaria trinitatis Ames is only a vegetatively large *M. brunnea*, and it is herewith reduced to synonymy.

NOMENCLATURAL ALTERATION

Maxillaria brunnea Linden & Reichb. f., Bonplandia 2: 281. 1854. TYPE: Colombia. Norte de Santander: Ocaña, 7,000′, May, *Funck & Schlim 1161* (holotype, W, photo).

Maxillaria trinitatis Ames, syn. nov. Sched. Orch. 2: 34. 1923. *Maxillaria trinitensis* Broadway, Orchid Rev. 34: 202. 1926 (sphalm.). TYPE: Trinidad–Tobago. Trinidad: Aripo, *Broadway 9890* (holotype, AMES).

Acknowledgments. The curators of AMES, MO, SEL, and VEN kindly made their specimens available. We are grateful to AMES for the use of G. C. K. Dunsterville's line drawings. John Dwyer reviewed the Latin diagnosis. Calaway H. Dodson provided useful comment on an earlier draft of this article. The senior author thanks Marie Selby Botanical Gardens for the granting of an internship during which the true identity of this species was revealed, and the Missouri Botanical Garden for travel support. A scholarship from the Federated Garden Clubs of Missouri to the senior author also helped make this study possible and is gratefully acknowledged.

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Eight New Species of *Masdevallia* (Orchidaceae) from South America

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The following eight species described as new in *Masdevallia* represent three of the five subgenera, in seven different subdivisions (Luer, 1986). *Masdevallia anceps* and *M. sertula* are multiflowered, Ecuadorian species of subgenus *Amanda* sect. *Amandae*, and *M. indecora* is a single-flowered, Colombian species in subgenus *Amanda* sect. *Pygmaeae;* in subgenus *Masdevallia* sect. *Masdevallia* are *M. dudleyi* from Peru in subsection *Masdevallia*, *M. eucharis* from Ecuador in subsection *Caudatae*, and *M. rubeola* from Bolivia in subsection *Oscillantes;* the Colombian *M. zapatae* belongs in section *Reichenbachianae* subsect. *Dentatae;* and *M. ximenae* from Ecuador is a member of the small subgenus *Meleagris*.

Masdevallia anceps Luer & Hirtz, sp. nov. TYPE: Ecuador. Napo: epiphytic in forest above La Bonita, 2,000 m, Feb. 1991, *A. Hirtz 5148* (holotype, MO), C. Luer illustration 15272. Figure 1.

Species haec *M. abbreviatae* Reichb. f. affinis, sed habitu multiminore et racemo bifloro floribus perparvis differt.

Plant very small, epiphytic, caespitose; roots slender. Ramicauls slender, erect, 10–14 mm long, enclosed by 2–3 thin, tubular sheaths. Leaf erect, thinly coriaceous, long-petiolate, 2.5–4 cm long including the petiole 1–2 cm long, the blade narrowly elliptical, subacute, 3–4 mm wide, the base narrowly cuneate into the slender petiole. Inflorescence a simultaneously 2-flowered raceme, the flowers 1 cm apart, borne by a slender, erect peduncle 2–2.5 cm long, with a bract above the base, from low on the ramicaul; floral bracts inflated, 2.5–3 mm long; pedicels 1.5–2 mm long; ovary 1.5 mm long, with 6 crests; sepals pale yellow with small, red spots, glabrous, the margins minutely erose, the dorsal sepal obovate, concave, 6 mm long, 4 mm wide expanded, connate to the lateral sepals for 2.5 mm to form a sepaline cup, the apex obtuse, contracted into a straight, stout, forward tail 4 mm long, the lateral sepals elliptical, oblique, 5.5 mm long, 1.6 mm wide, connate 2 mm, the bases forming a round mentum below the column-foot, the apices acute, contracted into stout tails 4 mm long; petals white, oblong, 2.25 mm long, 1.25 mm wide, the apex tridentate, the margins minutely serrate, with a longitudinal carina within the labellar margin; lip white, suffused with purple toward the base, oblong, arcuate, 3 mm long, 1 mm wide unexpanded, the sides rigidly erect, terminating abruptly as a pair of lamellae on the distal third, apex ovate, acute, with undulate margins, the disc superficially channeled, the base subcordate, hinged beneath; column stout, semiterete, 1.5 mm long, with a stout foot 2 mm long.

Etymology. From the Latin *anceps*, "two-headed," referring to the two-flowered inflorescence.

This species seems most closely related to *M. abbreviata* of southwestern Ecuador. Except for *M. amanda*, it is the first member of the subgenus *Amanda* to be found on the eastern slopes of the Ecuadorian Andes. All the others are known from the western declivities. *Masdevallia amanda* ranges through all three cordilleras of Colombia, another much larger two-flowered species (*M. alvaroi*) occurs in the Central Cordillera of Colombia, and several others occur in northwestern Peru.

Masdevallia anceps is distinguished from *M. abbreviata* and *M. amanda* by the very small habit, and the tiny, distantly two-flowered inflorescence. The shapes of the petals and lips of all these species are very similar except for the smaller size of those of *M. anceps*.

Masdevallia dudleyi Luer, sp. nov. TYPE: Peru. Dept. of Ayacucho: Prov. La Mar, eastern massif of the Cordillera Central opposing the Cordillera Vilcabamba, epiphytic in hepatic forest, along Inca trail between Huanhuachayo and Punccu, 2,920–3,400 m, 23 Aug. 1968, *T. R. Dudley 11975* (holotype, MO; isotype, NA), C. Luer illustration 12984. Figure 2.

Species haec *Masdevalliae affinis* Lindley similis, sed petalis angustioribus cum dente basalibus longioribus, et labello apice tricalloso differt.

Plant medium in size, epiphytic, caespitose; roots coarse. Ramicauls erect, slender, 3–4.5 cm long,

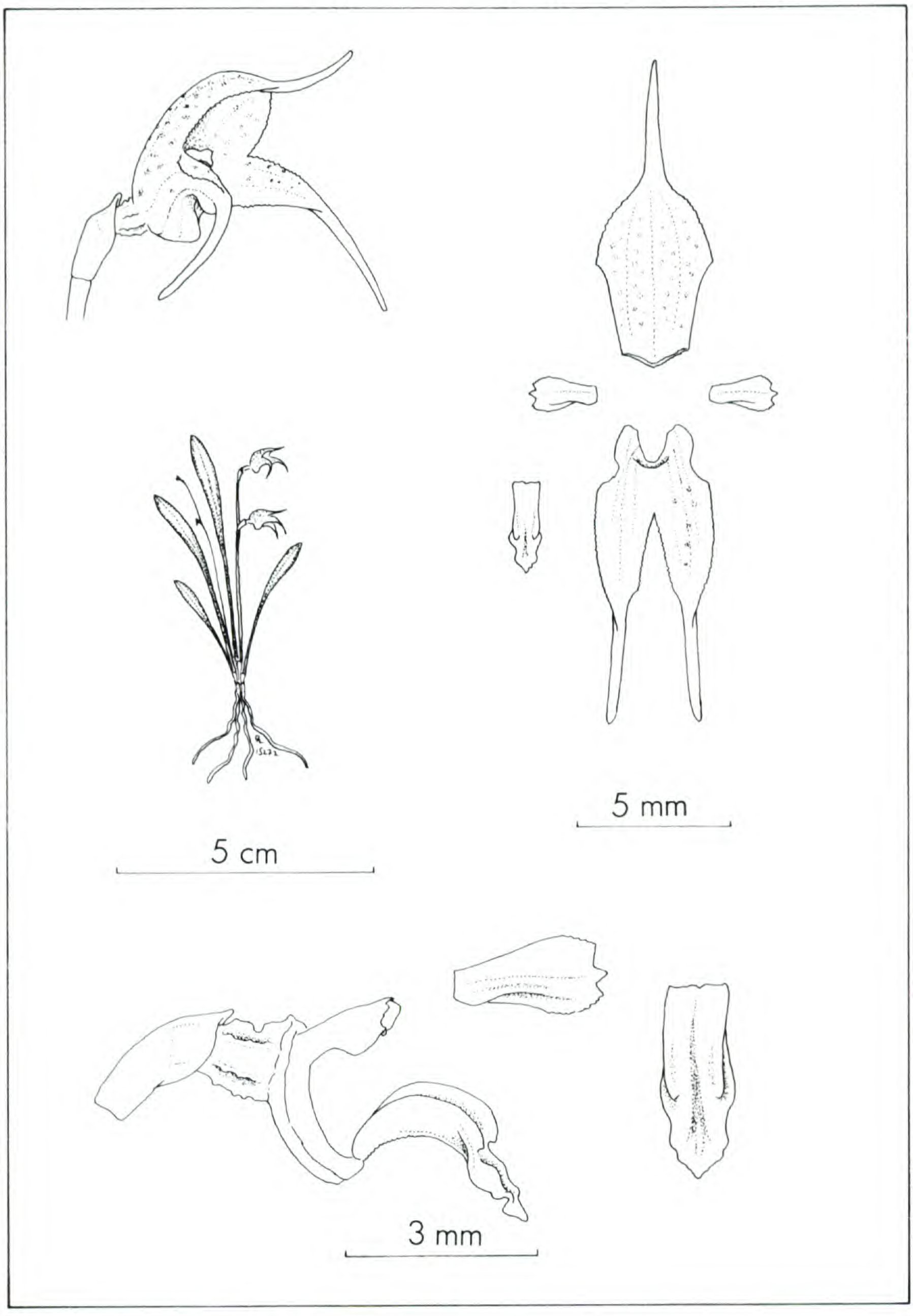

Figure 1. *Masdevallia anceps* Luer & Hirtz.

enclosed by 2–3 inflated, tubular sheaths. Leaf erect, coriaceous, petiolate, 10–17 cm long including the 3–5 cm long petiole, the blade elliptical, acute, 2–2.5 cm wide, cuneate below into the petiole. Inflorescence a solitary showy flower, borne by a slender, erect peduncle 9–11 cm long, with a bract above the base, from low on the ramicaul; floral bract oblique, 10–12 mm long; pedicel 15–20 long; ovary 7 mm long; sepals white, sparsely dotted with purple, suffused with yellow toward the base, pubescent above the middle, the dorsal sepal obovate, concave, 17 mm long, 10 mm wide, connate to the lateral sepals for 11 mm to form a broad, sepaline cup, the apex obtuse, contracted into a slender tail 29–31 mm long, the lateral sepals ovate, oblique, 17 mm long, 10 mm wide, connate 10 mm to create a broad, shallow, secondary mentum and a shallow mentum with the column-foot, the apices obtuse, contracted into slender tails similar to that of the dorsal sepal; petals white, oblong, 8 mm long, 2 mm wide, the apex obtuse, bilobulate, the labellar margin with a narrow callus ending in a retrorse process

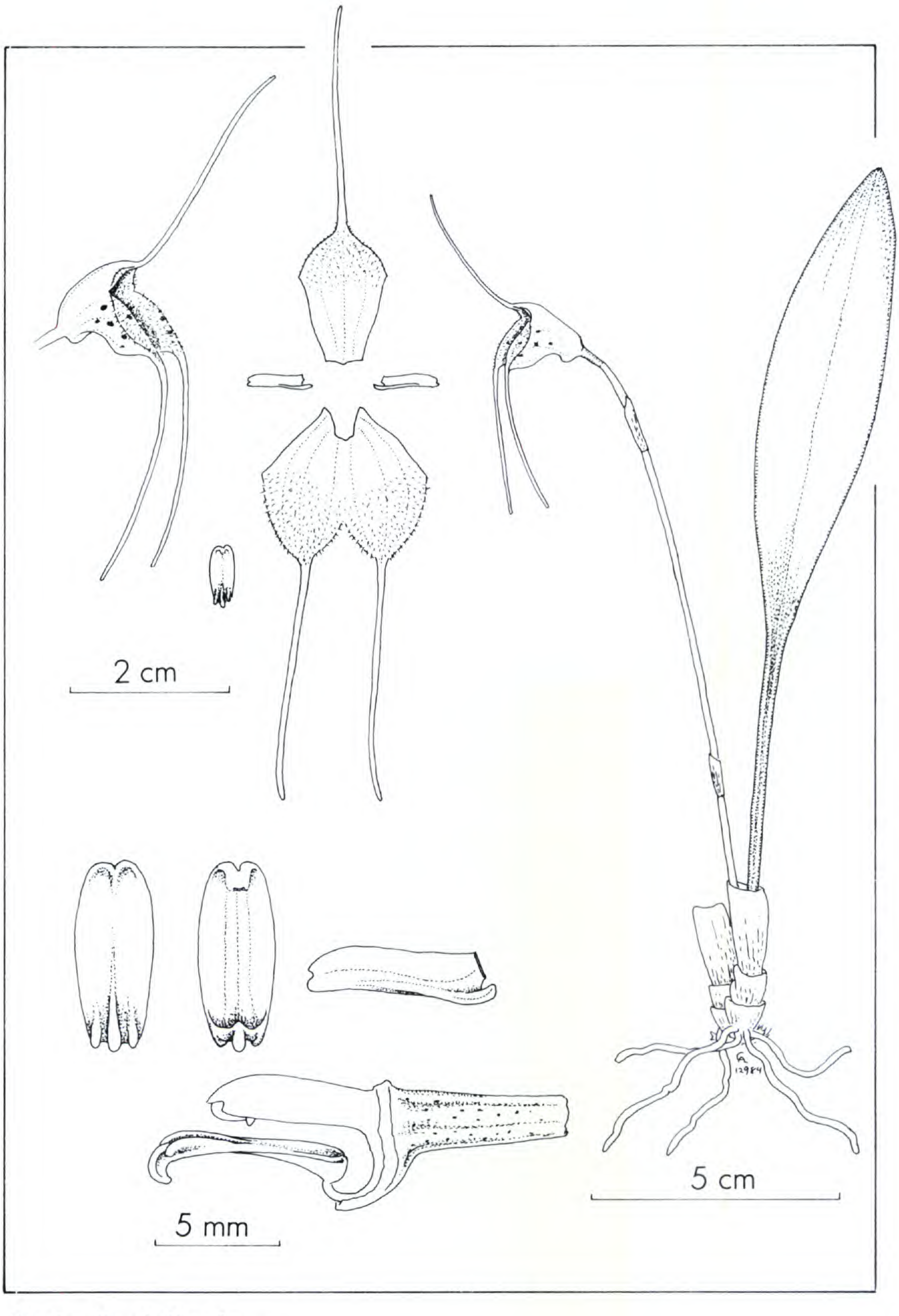

Figure 2. *Masdevallia dudleyi* Luer.

protruding beyond the base; lip oblong, 8 mm long, 3.25 mm wide, the apex broadly rounded, decurved, with three smooth, rounded calli, the disc featureless below the apex, the base subcordate, slightly concave, hinged beneath; column semiterete, 7 mm long, the foot 3.5 mm long, including an incurved extension.

Etymology. Named in honor of T. R. Dudley, who discovered this species.

This species from southern Peru is allied to *M. lepida* Reichb. f. of the Eastern Cordillera of Colombia, and to the widely distributed and variable *M. affinis* from much of the Andes of Colombia and northernmost Ecuador. *Masdevallia affinis* is replaced by prominently purple-striped *M. corderoana* Lehm. & Kränzlin in Ecuador. The latter has not yet been reported from Peru.

Florally, *M. dudleyi* is most similar to *M. affinis*. The gaping flowers pubescent within are mostly white

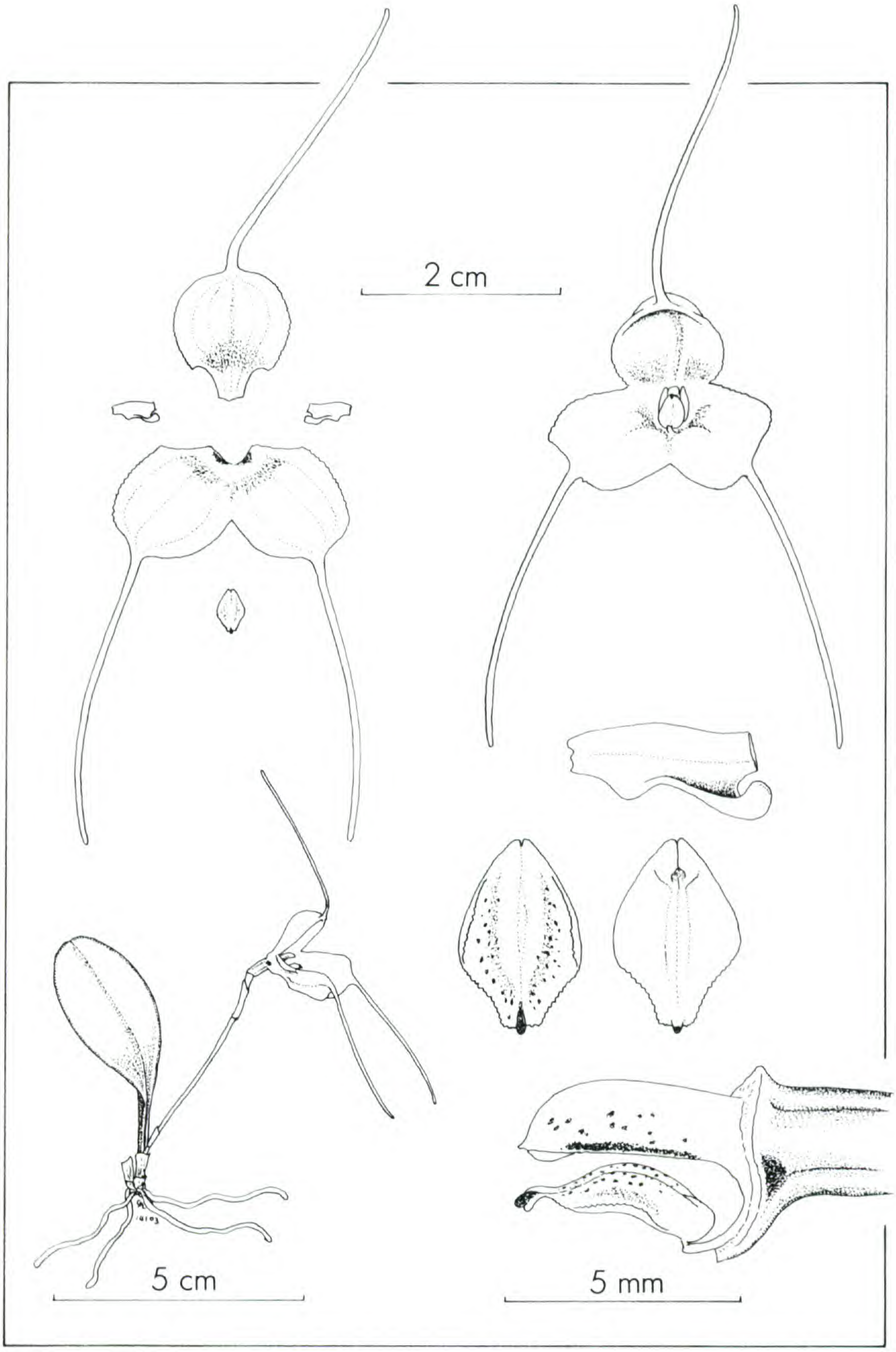

Figure 3. *Masdevallia eucharis* Luer.

with purple dots. From all the above, *M. dudleyi* is distinguished by the narrowly oblong petals with a slender marginal carina terminating in a retrorse process that projects beyond the base of the petal, and the lip that is tricallous at the apex.

Masdevallia eucharis Luer, sp. nov. TYPE: Ecuador. Zamora–Chinchipe: above Yangana, ca. 1,800 m, 1987, obtained from Dennis D'Alessandro, flowered in cultivation at Colombor-quídeas, El Retiro, Colombia, 5 Mar. 1989, *C. Luer 14103* (holotype, MO). Figure 3.

Species haec *Masdevalliae bottae* Luer & Andreetta similis, sed sepalis multicoloribus et labello rhombiformi minute eroso differt.

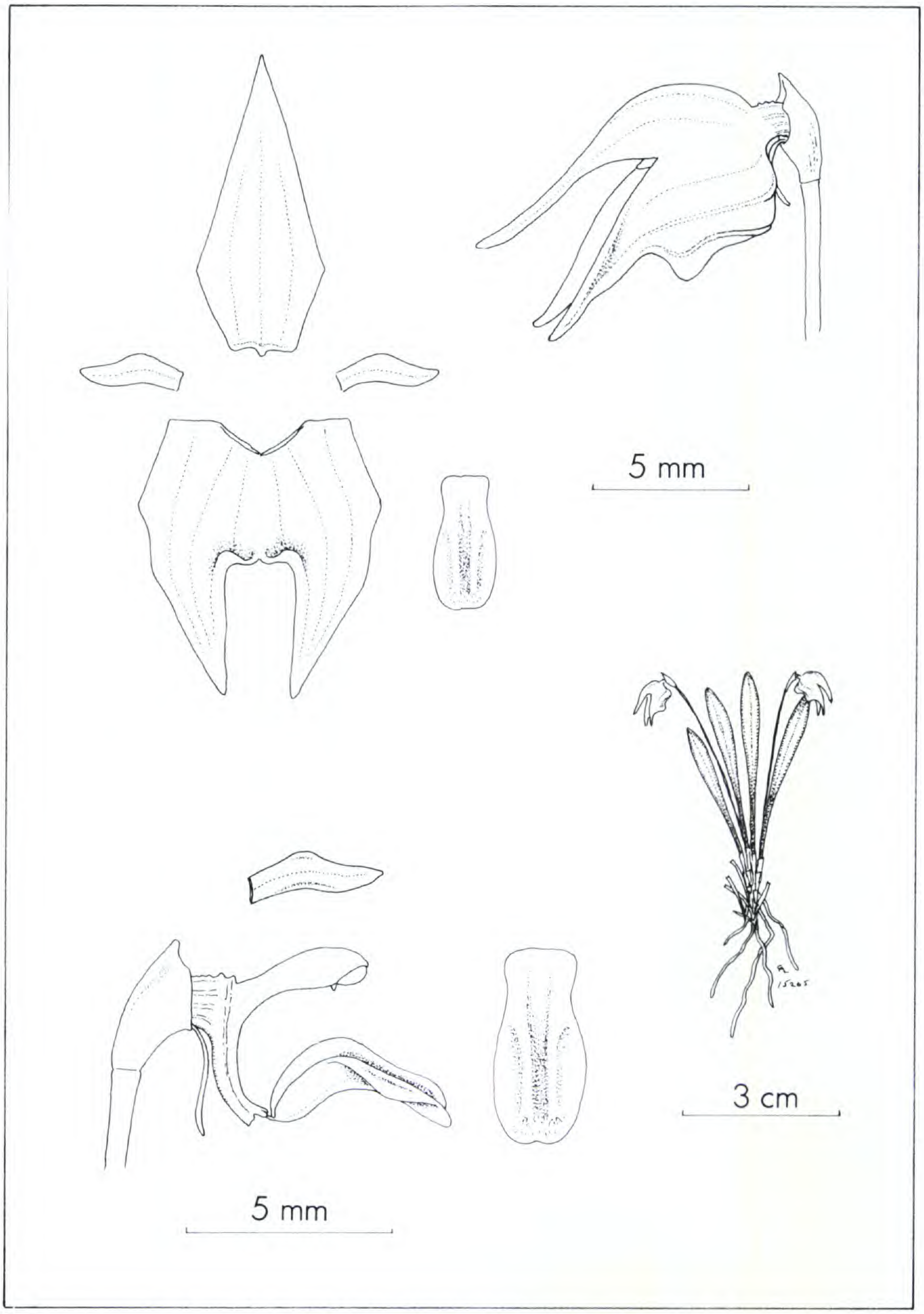

Figure 4. *Masdevallia indecora* Luer & Escobar.

Plant small, epiphytic, caespitose; roots slender. Ramicauls blackish, erect, slender, 1–1.5 cm long, enclosed by 2–3 tubular sheaths. Leaf erect, coriaceous, petiolate, 4–5 cm long including the petiole 1–1.5 cm long, the blade elliptical, obtuse to rounded, 1.7–2.1 cm wide, cuneate below into the petiole. Inflorescence a solitary showy flower, borne by a slender, erect peduncle 25–28 mm long, with a bract above the base, from low on the ramicaul; floral bract tubular, 8 mm long; pedicel 9 mm long; ovary 4 mm long; sepals yellow to peach, suffused below the middle with red-brown, glabrous, the dorsal sepal suborbicular-obovate, concave, 12 mm long, 11 mm wide, connate to the lateral sepals for 5 mm to form a shallow, conical, sepaline cup, the apex rounded, abruptly contracted into a slender tail 29–32 mm long, the lateral sepals suborbicular to broadly ovate, oblique, 14 mm long, 11 mm wide, connate 5 mm to form a transverse lamina, the apices transverse to obtuse, abruptly contracted into slender tails sim-

ilar to that of the dorsal sepal; petals yellow, oblong, 4 mm long, 1.5–2 mm wide, the apex truncate, obscurely trilobulate, the labellar margin with a longitudinal callus with an obtuse angle above the middle, thickened below the middle, ending in a retrorse process protruding beyond the base; lip yellow with purple dots, rhombic, 4 mm long, 2.75 mm wide, with the margins thin, minutely erose, obtusely angled near the middle, the apex narrowly truncate, with a small, red-brown, midline callus, the disc longitudinally thickened centrally, the base narrowly cordate, hinged beneath; column yellow with purple dots and margins, semiterete, 4.5 mm long, the foot 1 mm long, with an incurved extension.

Etymology. From the Greek *eucharis*, "lovely, pleasing," in allusion to the aspect of the plant.

This species from southern Ecuador is another of the numerous species closely allied to *M. xanthina* Reichb. f. It is closely related to the usually white-flowered *M. bottae*, also from southern Ecuador, but it resembles the Peruvian *M. rufescens* Königer of subsection *Oscillantes*, which also grows in the area. From the latter two *M. eucharis* is distinguished by the peach and red-brown suffused sepals, and a rhombic lip with thin, minutely erose, obtusely angled margins, and with the disc longitudinally callous. Some clones of *M. bottae*, a species characterized by a subquadrate lip, are similarly colored.

The "diamond-shaped" lip of *M. eucharis* is reminiscent of the lip seen in subsection *Oscillantes*. If it were not for the petals with the thick, incurved, basal process, this species might be considered to belong in subsection *Oscillantes*.

Masdevallia indecora Luer & Escobar, sp. nov. TYPE: Colombia. Antioquia: Munic. of Jardin, epiphytic in forest near Cinfuentes, 2,600 m, collected by M. Zapata, flowered in cultivation at Colomborquídeas, 24 Mar. 1991, *C. Luer 15265* (holotype, JAUM; isotype, MO). Figure 4.

Species haec *Masdevalliae anachaetae* Reichb. f. affinis sed ovario minime spiculato, sepalis ecaudatis, petalis sine dente basali et labello alte bicarinato differt.

Plant very small, epiphytic, ± ascending, caespitose; roots slender. Ramicauls erect, slender, 7–10 mm long, enclosed by 2–3 tubular sheaths. Leaf erect, coriaceous, narrowly elliptical to obovate, acute to subacute, 20–30 mm long, 3–4 mm wide, gradually narrowed below into the subpetiolate base. Inflorescence a single, ± downward-facing flower borne by a slender, erect peduncle 30–35 mm long, with a bract above the base, from low on the ramicaul; floral bract oblique, 3.5 mm long; pedicel 2 mm long, with an equally long filament; ovary 1.5 mm long, carinate, the carinae minimally denticulate; sepals yellow, suffused with red-brown, glabrous, the dorsal sepal ovate, concave, 9.5 mm long, 4.5 mm wide, connate to the lateral sepals for 3 mm to form a broad, cylindrical tube, the apex acute, the lateral sepals ovate, oblique, 10 mm long, 4 mm wide, connate 3.5 mm to create a prominent secondary mentum and a deep primary mentum with the column-foot, the free portions triangular, acute; petals white, membranous, obliquely oblong, 3.5 mm long, 0.8 mm wide, the apex acute, the labellar margin very slightly thickened, the upper margin obtusely angled near the middle; lip yellow-brown, oblong, 4.5 mm long, 2 mm wide, the apex broadly rounded, the disc channeled between a pair of longitudinal carinae, the base subtruncate, hinged beneath; column semiterete, 3.5 mm long, the foot 3 mm long, with a short, incurved extension.

Etymology. From the Latin *indecorus*, "not beautiful," in allusion to the flower.

This species of section *Pygmaeae* subg. *Amanda* is most closely allied to *M. anachaeta*. In habit it resembles *M. anachaeta* with a small, nodding flower, but the sepals are acute without forming tails. The characteristic tooth at the base of the petals of *M. anachaeta* is lacking, and the lip is tall-bicarinate.

Masdevallia rubeola Luer & Vásquez, sp. nov. TYPE: Bolivia. La Paz: Prov. of Nor Yungas, epiphytic in forest north of Caranavi, 1,550 m, collected 26 Jan. 1988 by R. Vásquez, C. Luer, et al., flowered in cultivation by P. and A. Jesup in Bristol, Connecticut, Aug. 1988, *C. Luer 15265* (holotype, MO). Figure 5.

Species haec *Masdevalliae ortalis* Luer affinis sed sepalis rufoguttatis, et petalis minutis margine inferiore supra medium dilatato differt.

Plant medium in size, epiphytic, caespitose; roots slender. Ramicauls blackish, erect, slender, 0.5–1.5 cm long, enclosed by 2–3 tubular sheaths. Leaf erect, coriaceous, dark green, mottled with black beneath, 5–9 cm long including the petiole 2–3 cm long, the blade elliptical-obovate, subacute to acute, 1.5–2 cm wide, cuneate below into the blackish petiole. Inflorescence a single, ±downward-facing flower, borne by a slender, suberect to subhorizontal peduncle 3–4 cm long, with a bract above the base, from low on the ramicaul; floral bract tubular, 6 mm long; pedicel 11 mm long; ovary 6 mm long; sepals yellow, diffusely dotted with red-brown, glabrous, the dorsal sepal broadly ovate to suborbicular,

concave, 13 mm long, 11 mm wide, connate to the lateral sepals for 3.5 mm to form a shallow, gaping sepaline cup, the apex rounded, abruptly contracted into an acutely reflexed tail 20 mm long, the lateral sepals suborbicular, oblique, 14 mm long, connate 8 mm to create a transverse lamina 20 mm wide, the apices rounded, abruptly contracted into deflexed tails 15 mm long; petals yellow, obliquely oblong-obovate, 2 mm long, 1 mm wide, the apex obtuse, obscurely bilobed, the labellar margin prominently and broadly dilated above the middle, with a minute tooth above the base; lip yellow, dotted with brown, trilobed, 3 mm long, 1.5 mm wide across the middle lobes, narrowed in the distal third with the obtuse apex callous and acutely revolute, the lateral lobes thin, obtuse, expanded at the middle, the basal third narrow, thickened, convex, concave beneath, immovably attached to the column-foot; column semiterete, 3.5 mm long, the foot 1 mm long.

Etymology. From the Latin *rubeola*, "measles," in allusion to the multiple red spots on the sepals.

This species of subsection *Oscillantes* is most closely allied to the Peruvian *M. ortalis* but is also closely allied to *M. rodolfoi* (Braas) Luer. The leaves are dark green, mottled with black on the back surface, and with black stems. The flower, more or less facing downward, is yellow and diffusely dotted with red-brown. The lip is basically similar in all three species, but smaller in *M. rubeola*. The petals of *M. rubeola* are only one-fourth the size (half the dimensions) of the petals of the other two, and the lower margin is widely dilated above the middle instead of with an acute process.

Masdevallia sertula Luer & Andreetta, sp. nov. TYPE: Ecuador. Cañar: above Molleturo, ca. 2,800 m, collected by A. Andreetta, flowered in cultivation at Paute, *A. Hirtz 5037* (holotype, MO), C. Luer illustration 15271. Figure 6.

Inter species subgeneris *Amandae*, inflorescentia congesta coronanti floribus magnis cum caudis crassis deflexis, petalis maculatis apiculatis serrulatis, et labello parvo oblongo-subpandurato cum lateribus et apice decurvis distinguitur.

Plant medium in size, epiphytic, caespitose; roots coarse. Ramicauls rather stout, erect, 2–2.5 cm long, enclosed by 2–3 thin, tubular sheaths. Leaf erect, coriaceous, petiolate, 10–13 cm long including the petiole 3–4 cm long, the blade elliptical, obtuse, 2 cm wide, the base cuneate into the slender petiole. Inflorescence a congested, simultaneously several-flowered raceme, ca. 1 cm long, borne by an erect peduncle 14–16 cm long, with 2 bracts spaced along the length, from low on the ramicaul; floral bracts inflated, 6–7 mm long; pedicels 3–4 mm long; ovary 3–4 mm long, with 6 crests; sepals orange with diffuse, minute, purple dots, ± coalescing into bars below the middle, the margins microscopically erose, with orange hairs within the margins easily shed, becoming glabrous, the dorsal sepal elliptical, concave, 15 mm long, 9 mm wide unexpanded, connate to the lateral sepals for 6 mm to form a nongaping cup, the apex obtuse, contracted into a straight, stout, downward-pointed tail 18–19 mm long, the lateral sepals elliptical, oblique, subacute, 14 mm long, 5 mm wide, connate 4 mm, the bases forming a round mentum below the column-foot, deflexed at the apices where contracted into stout tails 15 mm long; petals white with numerous dark purple dots, oblong, 4 mm long, 1.5 mm wide, the apex truncate, apiculate, the margins minutely serrate, with a longitudinal carina within the labellar margin; lip white, suffused with purple above the middle, oblong-subpandurate, 3.75 mm long, 1.4 mm wide, the apex rounded with deflexed margins of the sides and apex deflexed, the disc superficially channeled between ill-defined marginal folds above the middle, the base subcordate, hinged beneath; column green with purple dots, stout, semiterete, 3.5 mm long, with an equally long, stout column-foot.

Etymology. From the Latin *sertula*, "a little wreath or a crown," referring to the appearance of the inflorescence.

This species is closely related to *M. ova-avis* Luer and *M. tridens* Reichb. f. All three species are characterized by several relatively large flowers borne simultaneously in a congested raceme, the flowers arranged in a more or less circular, horizontal plane. *Masdevallia sertula* is distinguished from them by the orange color of the flowers with minute, purple dots. The dots are similar to those on the bluish sepals of *M. ova-avis*. The flowers of the unspotted *M. tridens* are smaller than those of the other two.

Instead of slender, the sepaline tails of *M. sertula* are thick, the laterals deflexed at their junction with the blades. The petals of all three species are similar in shape, those of *M. ova-avis* and *M. sertula* similarly diffusely dotted. The configuration of the lip of *M. sertula* is similar to that of *M. tridens*, with the margins deflexed, but the lip of the larger-flowered *M. sertula* is proportionately smaller than that of the other two.

Masdevallia ximenae Luer & Hirtz, sp. nov. TYPE: Ecuador. Bolívar: epiphytic in wet for-

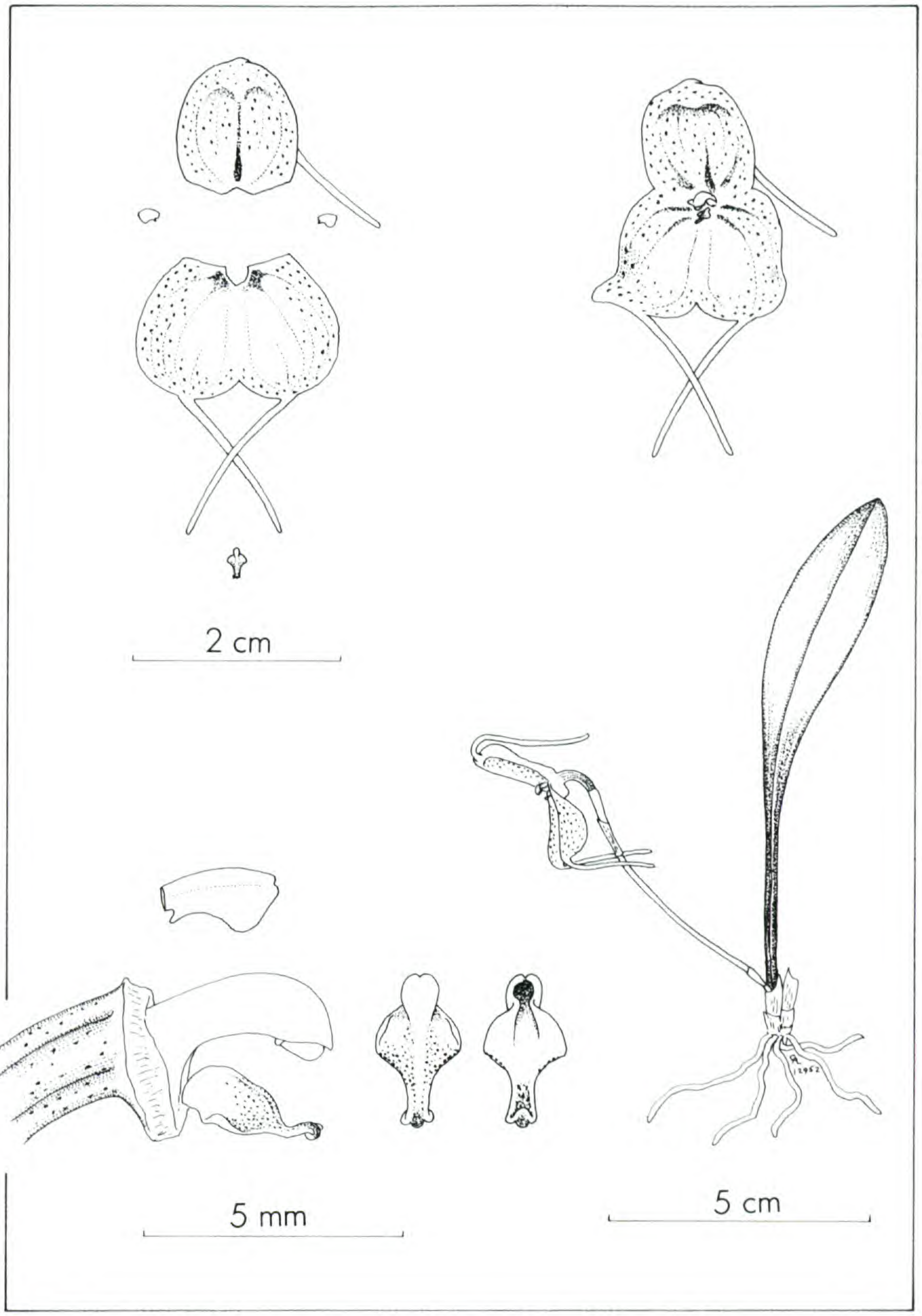

Figure 5. *Masdevallia rubeola* Luer & Vásquez.

est, 1,250 m, W of Salinas and La Palma, 10 Mar. 1991, *C. Luer, J. Luer, A. Hirtz, X. Hirtz, J. del Hierro, M. Evans, M. & F. Navarro 14970* (holotype, MO; isotypes, K, QCNE). Figure 7.

Inter species subgeneris *Meleagridis*, sepalo dorsali ovato concavo glabro cum maculis latis transversis marginalibus et petalis cum callo basali rotundato distinguitur.

Plant small, epiphytic, caespitose; roots slender. Ramicauls slender, erect, 1–1.5 cm long, enclosed by 2–3 thin, tubular sheaths. Leaf erect, thinly coriaceous, petiolate, 4–9 cm long including the petiole 1.5–3 cm long, the blade elliptical, acute, 1–2 cm wide, the base cuneate into the slender, channeled petiole. Inflorescence a congested, successively few-flowered raceme, borne by a slender, erect peduncle 5–9 cm long, with a bract near the middle, embraced below by the conduplicate base of the leaf, from low on the ramicaul; floral bracts thin, tubular, imbricating, 5–6 mm long; pedicel 7 mm long; ovary 1.5–2 mm long; sepals glabrous,

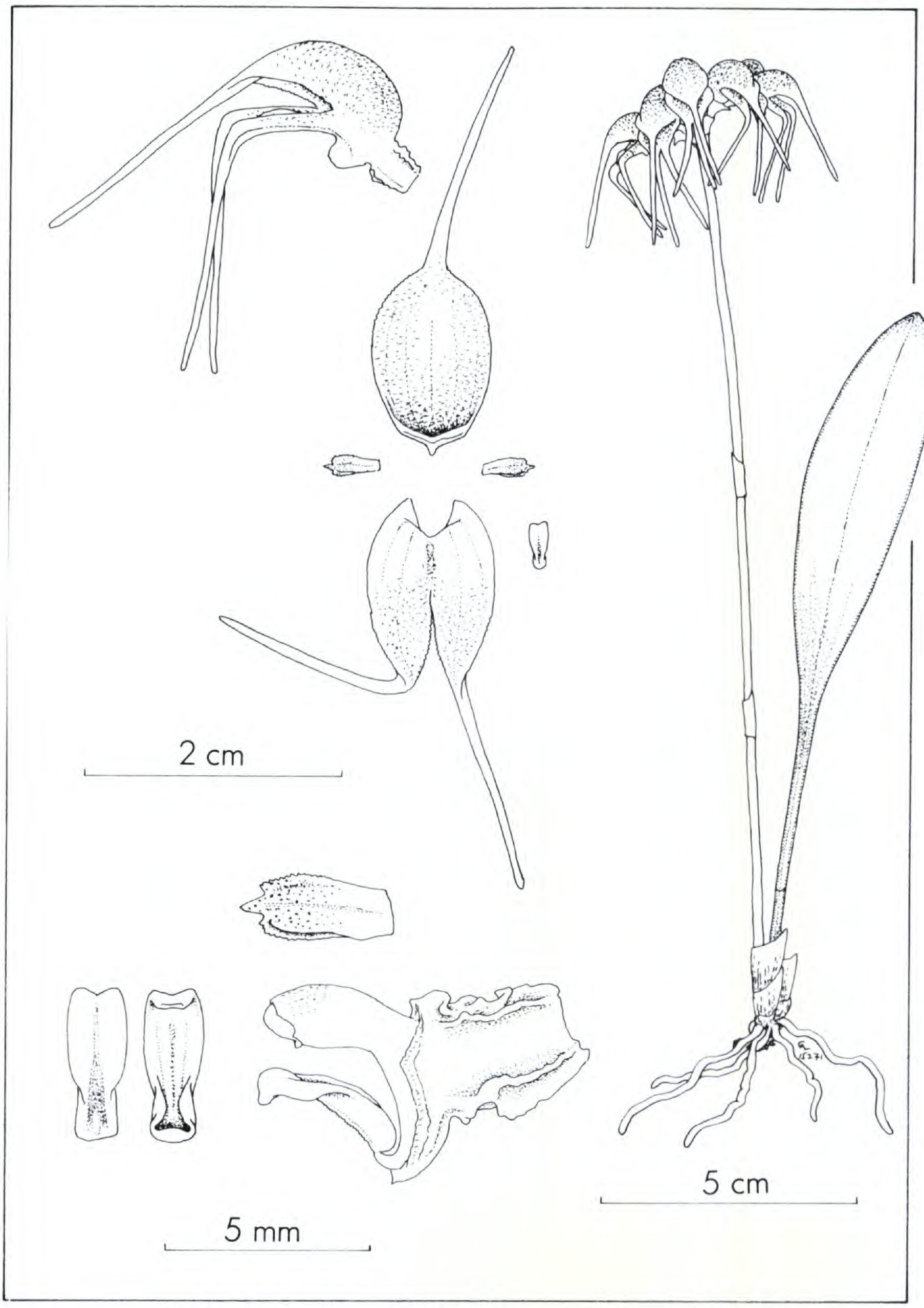

Figure 6. *Masdevallia sertula* Luer & Andreetta.

the dorsal sepal yellow with brown, marginal bars, ovate, concave, 7 mm long, 5.5 mm wide, connate to the lateral sepals for 1 mm to form a gaping, shallow cup, the apex obtuse, contracted into a slender (slightly thickened in the middle portion), reflexed, brown-spotted tail ca. 12 mm long, the lateral sepals red-brown with obscure brown, marginal bars, oblong, 9 mm long, 3 mm wide, essentially free but connate to the column-foot to form a round mentum, then deflexed, the apices subacute, contracted into slender, brown-spotted tails ca. 11 mm long; petals orange with a few red dots, oblong, 3.5 mm long, 1.25 mm wide, the apex shortly apiculate, the labellar margin with a longitudinal carina ending in a rounded callus at the base; lip red, flecked with darker red, oblong-subpandurate, arcuate, 3.5 mm long, 2 mm wide, the apex rounded, reflexed, the disc with a low, midline callus ending at the apex, the base subcordate, thinly hinged beneath the thickened base to the under margin of the apex of the column-foot; column yellow, semiterete, 3 mm long, with an equally long, curved column-foot.

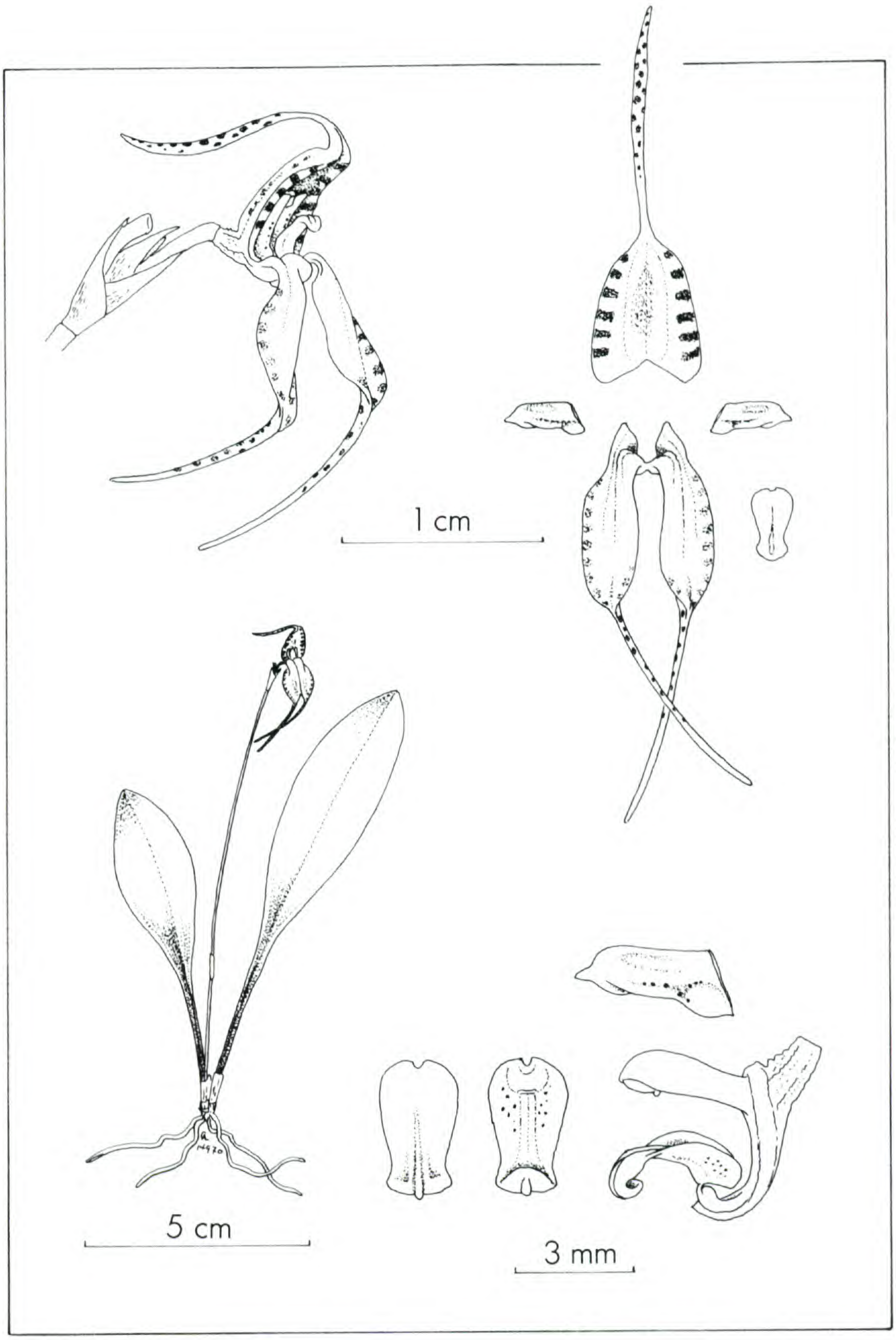

Figure 7. *Masdevallia ximenae* Luer & Hirtz.

Etymology. Named in honor of Ximena de Hirtz, codiscoverer of this species.

This species closely resembles *M. parvula* Schltr. and *M. alexandri* Luer, but it seems most closely related to the Colombian *M. planadensis* Luer & Escobar, with which it grows in Ecuador. From *M. parvula* it is distinguished by the glabrous sepals marked with large, marginal bars instead of small, random spots. The petals are similar to those of *M. planadensis* with a rounded callus at the base. *Masdevallia parvula* occurs at altitudes over 2,600 m above sea level; *M. ximenae* is found at an altitude less than half as high.

From *M. alexandri* it is distinguished by the much shorter sepaline tails; sepals with broad, marginal bars instead of minute, random dots; and an ovate instead of an orbicular dorsal sepal.

From the Colombian *M. planadensis*, found for

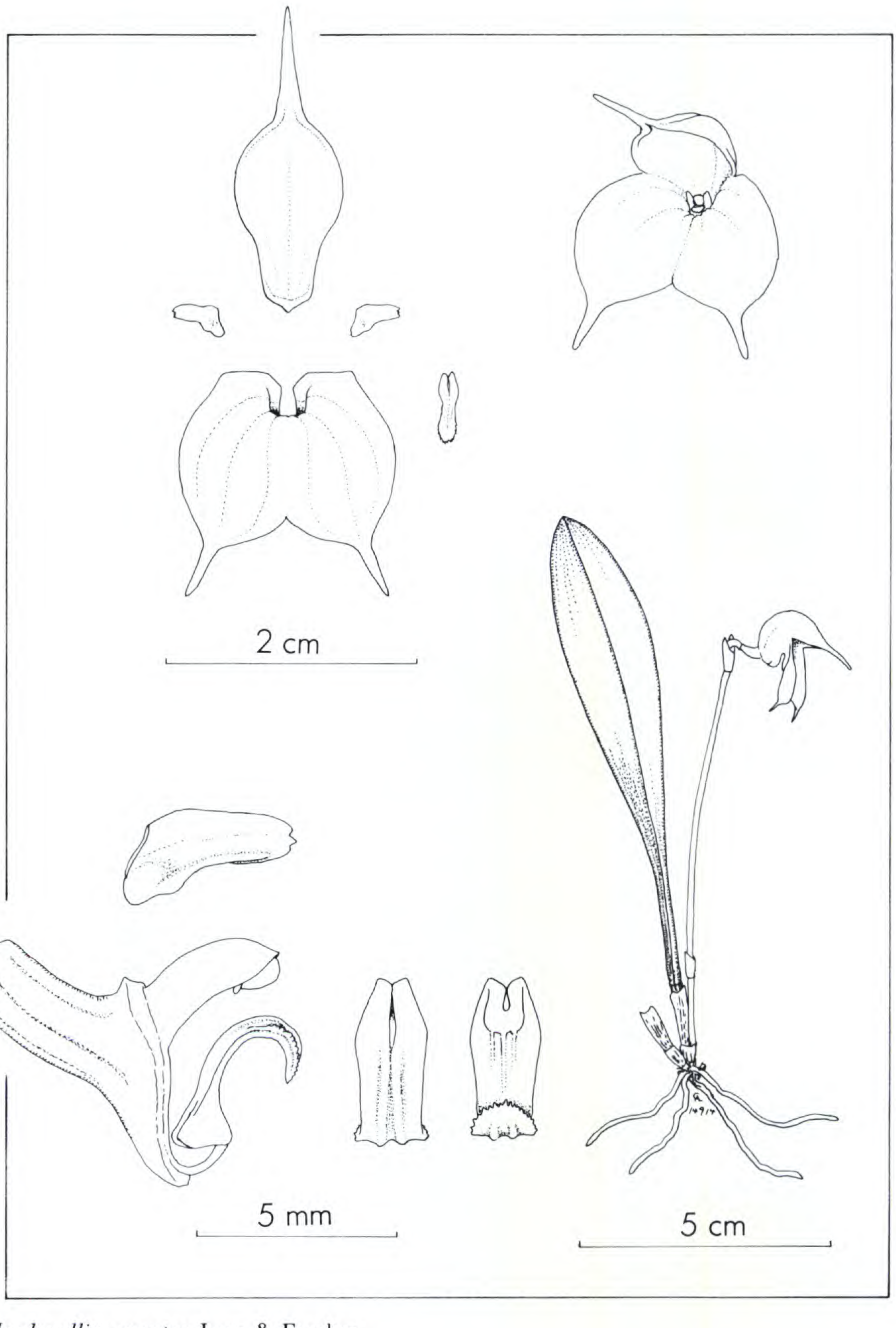

Figure 8. *Masdevallia zapatae* Luer & Escobar.

the first time in Ecuador and growing with *M. ximenae*, it is distinguished by smaller flowers prominently marked with red and purple.

Masdevallia zapatae Luer & Escobar, sp. nov. TYPE: Colombia. Antioquia: Munic. of Urrao, "El Llavero," 1,400–1,600 m, collected by M. Zapata in Nov. 1989, flowered in cultivation at Colomborquídeas, 4 Nov. 1990, *R. Escobar 4054* (holotype, JAUM; isotype, MO). Figure 8.

Species haec *M. macrogeniae* (Arango) Luer & Escobar affinis, sed sepalo dorsali et sepalis lateralibus non profunde connatis, sepalorum caudis brevibus anguste triangularibus, et petalis labelloque minoribus differt.

Plant medium in size, epiphytic, caespitose; roots slender. Ramicauls erect, slender, 1–1.5 cm long, enclosed by 2–3 tubular sheaths. Leaf erect, cori-

aceous, 8–9.5 cm long including a petiole 1.5–2 cm long, the blade narrowly obovate, subacute to obtuse, 1.6–1.8 cm wide, narrowed below into the petiole. Inflorescence a congested, successively few-flowered raceme borne by a slender, erect peduncle 6–7 cm long, round in cross section, with a bract above the base, from low on the ramicaul; floral bract tubular, 6 mm long; pedicel 7–8 mm long; ovary 3–4 mm long; sepals red with purple spots, glabrous, the dorsal sepal obovate, concave, 14 mm long, 9 mm wide unexpanded, connate to the lateral sepals for 6 mm to form a short, cylindrical tube, the apex rounded, contracted into a yellow, forwardly directed, narrowly triangular, acute tail 8 mm long, the lateral sepals broadly ovate, 14 mm long, 10 mm wide, connate 10 mm over a transverse, 180° fold, the free portions rounded, contracted into narrowly triangular, descending tails 4 mm long; petals pink, spotted with purple, obliquely oblong, 4 mm long, 1 mm wide, 2.5 mm wide at the base, the apex obtuse, tridentate, the labellar margin with a longitudinal callus ending in a broad, thick rounded process at the base; lip spotted with purple, oblong, 6 mm long, 1.8 mm wide, the apex recurved, obtuse with a denticulate margin, the disc shallowly channeled between a low, longitudinal pair of calli, the base thickened, deeply cleft, hinged beneath; column suffused with purple, semiterete, 3 mm long, the foot thick, 5 mm long, with a slender, incurved extension.

Etymology. Named in honor of Manuel Zapata, who discovered this species.

This species is the third of a closely related group within subsection *Dentatae* of section *Reichenbachianae* that includes *M. dryada* and *M. macrogenia*. *Masdevallia zapatae* is readily recognized by the sepaline tails that are the shortest in the group. The tails are narrowly triangular, those of the laterals only 4 mm long. From *M. macrogenia*, which it resembles most, it is distinguished by the less deeply connate dorsal sepal, that is, connate to the lateral sepals for less than half its length. The dorsal sepal of *M. macrogenia* is connate to the lateral sepals for far more than half the length.

Literature Cited

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A New Species and a New Combination in *Ichnanthus* (Gramineae: Paniceae) from South America

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Ichnanthus P. Beauv. is a morphologically diverse grass genus composed of 39 species, of which all but one are restricted to the Neotropics (Stieber, 1982, 1987). Recent examination of herbarium specimens revealed that *Ichnanthus procurrens* (Nees ex Trin.) Swallen, a C_3 grass, has anatomy similar to C_4 species (Kirpes et al., in prep.). In the course of that study, it became apparent that morphological, anatomical, geographical, and ecological data supported the recognition of a segregate species, as well as separate varieties within *I. procurrens*.

Stieber (1987) recognized the distinct morphology, habitat preference, and geographic distribution of a group of annual plants from Maranhão (Brazil) and the Llanos of Venezuela. They were treated as ecotypes of *I. procurrens* because of a suspicion that the wider and thinner leaf blades were due to growth in a shaded habitat. A more detailed study has revealed foliar characteristics that are less subject to environmental variation (e.g., length : width ratios of leaf blades and the number of mesophyll cells between adjacent bundle sheaths), as well as additional traits that can be used to distinguish these plants from *I. procurrens*.

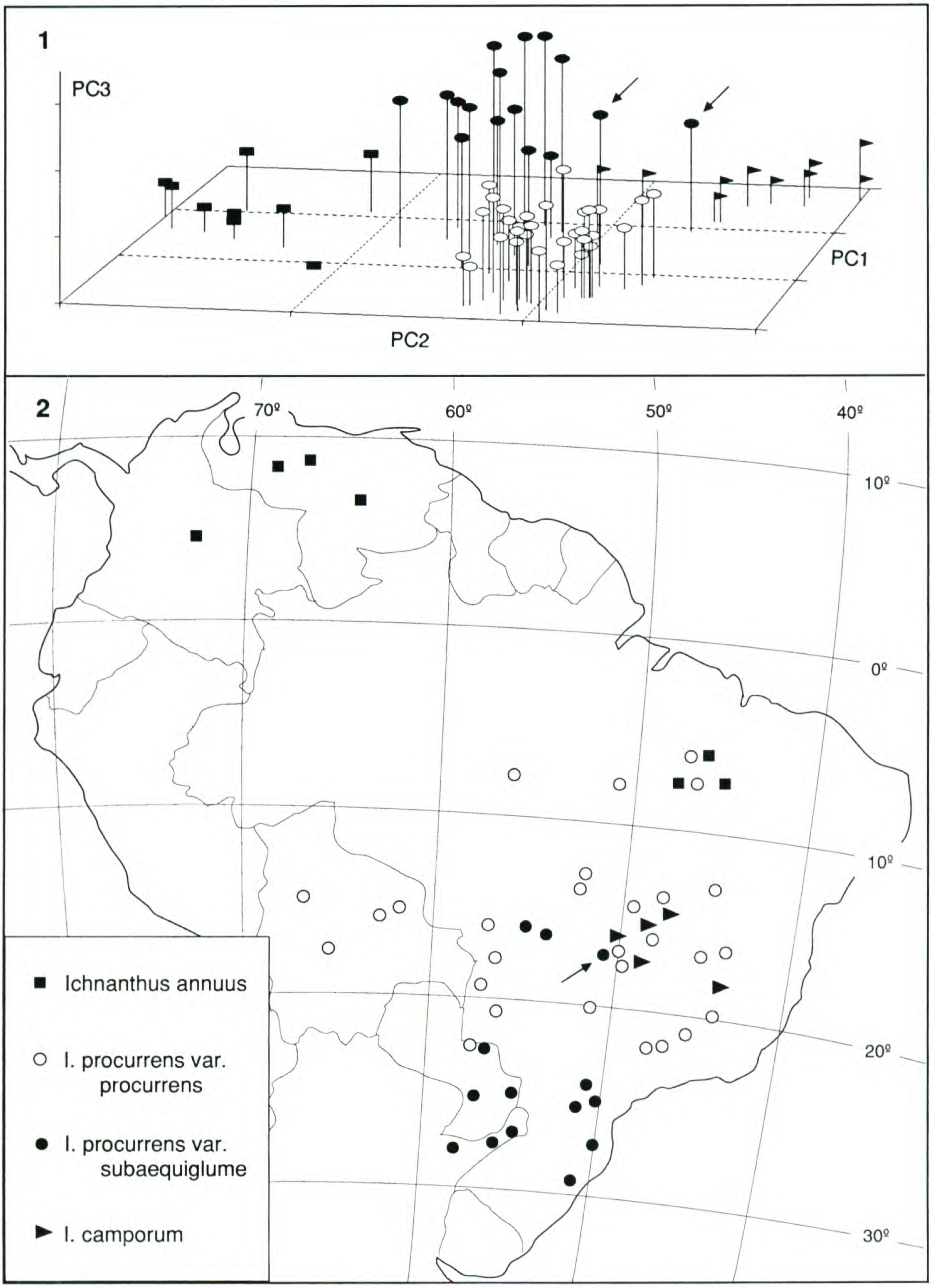
A principal components analysis was performed on a correlation matrix computed from 32 polymorphic traits measured from 66 selected specimens using the NTSYS software program (Rohlf, 1987). The related species, *Ichnanthus camporum* Swallen, was included in the analysis because variants of *I. procurrens* have been suggested to represent hybrid populations of *I. procurrens* and *I. camporum* (Swallen, 1964). Examination of the eigenvectors revealed that the first principal component separated the specimens by the variation associated with the diameter of culm internodes, rhizomatous habit, leaf blade dimensions, panicle size, and spikelet size. The second principal component reflected the variation among specimens due to annual or perennial habit, leaf blade anatomy, the length : width ratio of leaf blades, the presence of sclerified margins on leaf blades, and the nature of the apices of the spikelet bracts. The third principal component incorporated information relating to the length of the lower glume, the number of racemes, and the total number of spikelets. The analysis revealed three major groupings that corresponded to *I. annuus* (here described), *I. camporum*, and *I. procurrens* (Fig. 1). Specimens exist that are intermediate in morphology to all three species; nonetheless, *I. camporum* and *I. annuus* are sufficiently distinct to warrant recognition at the species level. *Ichnanthus procurrens* remains polymorphic, and two varieties are recognized.

This circumscription of taxa coincides with differences in geography and habitat preferences. *Ichnanthus annuus* has a northerly distribution (Fig. 2) and has only been collected in shaded sites. *Ichnanthus procurrens* var. *procurrens* is widely distributed throughout central Brazil and eastern Bolivia. It is most prevalent in open savanna wetland, particularly seasonally humid valley-side campos (Stieber, 1987; Killeen & Hinz, in review). *Ichnanthus procurrens* var. *subaequiglume* has a more southerly distribution and, although label data are lacking for many specimens, the available evidence indicates that this variety is restricted to well-drained savannas. *Ichnanthus camporum* has been collected on rocky slopes with sandy soils at elevations above 900 m in a restricted area of central Brazil.

The distinguishing characteristics of the four taxa are summarized in Table 1 and in the following key.

1a. Leaf blades (60–)80–200 mm long; spikelets glabrous, upper floret > 3.0 mm long; perennial from stout, bracteate rhizomes; plants restricted to well-drained rocky or sandy soils above 900 m ..... *I. camporum*

1b. Leaf blades 30–60(–80) mm long; spikelets sparsely to densely pilose, upper floret ≤ 3.0 mm long; annual or perennial, caespitose and procumbent or decumbent and rooting at the nodes but not with stout bracteate subterranean rhizomes; plants of various habitats.



Figures 1, 2. —1. Morphological similarities of 66 selected specimens as portrayed by a principal components axis of 32 polymorphic attributes. The first principal component (PC1) portrays 28% of the total variation; the second principal component (PC2) portrays 22% of the total variation; and the third principal component (PC3) portrays 12.5% of the total variation. Rectangles are *Ichnanthus annuus;* open balloons are *Ichnanthus procurrens* var. *procurrens;* closed balloons are *Ichnanthus procurrens* var. *subaequiglume;* and flags are *Ichnanthus camporum.* —2. Geographic distribution of *I. annuus*, *I. procurrens* var. *procurrens*, *I. procurrens* var. *subaequiglume*, and *I. camporum.* Arrows indicate putative hybrid specimens.

TABLE 1. Comparison between *Ichnanthus annuus*, *I. procurrens* var. *procurrens*, *I. procurrens* var. *subaequiglume*, and *I. camporum*.

Character	*I. annuus*	*I. procurrens* var. *procurrens*	*I. procurrens* var. *subaequiglume*	*I. camporum*
Duration	annual	perennial	perennial	perennial
Habit	decumbent	caespitose procumbent	caespitose procumbent (decumbent)	rhizomatous
L:W ratio of blade	3.5:1 (2.8–4.5:1)	11.2:1 (6.2–17.8:1)	6.3:1 (3.1–11.5:1)	17.8:1 (8.9–24.9:1)
Number of medial leaf veins	40–66	18–43	33–72	36–60
Number of mesophyll cells between bundle sheaths	6–10	2–4	4–7	3–6
Margin strongly sclerified (width of marginal nerve in mm)	no (0.07–0.16)	yes (0.21–0.35)	yes (0.18–0.35)	yes (0.21–0.30)
Length of inflorescence (mm)	40–80	35–70	80–150	100–180
Number of racemes	5–14	5–18	7–28	7–20
Raceme internodes (mm)	1–2.5	1–2.5	2–8	5–9
Medial spikelet clusters present	yes	yes	no	no
Length of spikelet (mm)	3.8–5	3.0–3.9	3.5–4.5	4.4–5.5
Ratio of lower glume:spikelet	2/3–3/4:1	1/2–3/4:1	3/4–5/4:1	2/3–3/4:1
Apex of upper glume and lower lemma	acuminate	blunt	acute	blunt
Length of upper floret (mm)	2.0–2.7	2.0–2.5	2.5–3.0	3.0–3.7
Habitat	shade/mesic	sun/humic	sun/mesic	sun/xeric
Distribution	north	central	south-central	central-east

2a. Annual; spikelets > 4.0 mm long, the glumes and lower lemma acuminate; leaf blades ovate to ovate-lanceolate (length:width ratio < 4:1), sclerification minimal, margins < 180 μm; plants of forests and forest margins ..... *I. annuus*

2b. Perennial; spikelets < 4.0 mm long, the glumes and lower lemma blunt to somewhat acute; leaf blades lanceolate to linear (length:width ratio > 4:1), sclerification moderate to heavy, margins 180 μm or greater; plants of savannas.

3a. Racemes (7–)10–28, internodes between scattered spikelet pairs 3–8 mm long; inflorescence 80–150 mm long; leaf blades 7–16 mm wide ..... *I. procurrens* var. *subaequiglume*

3b. Racemes 5–10(–18), internodes between medially clustered (Fig. 3A, B) spikelet pairs < 3 mm long; inflorescence 35–70 mm long; leaf blades 2–9 mm wide ..... *I. procurrens* var. *procurrens*

Ichnanthus annuus Killeen & Kirpes, sp. nov. TYPE: Brazil, Maranhão: Município de Loreto, Ilha de Balsas region between the Balsas and Parnaíba rivers, Fazenda da Morros, 7°23′S, 45°04′W, 300 m, 21 Feb. 1970, *Eiten & Eiten 10743* (holotype, US; isotypes, US, MO, NY). Figure 3.

Ichnanthus procurrens (Nees ex Trin.) Swallen affinis sed annuus; decumbens; ad nodos inferiores radicantes; lamina folii laxa, ovata usque ad lanceolata-ovata, minus quam latitudo suo 4-plo longiora; lamina margine non sclerotica valde; spicula 4 mm longiora; glumae et lemma infernum acuminatae.

Annual or of indefinite duration; culms decumbent, branching intravaginally and rooting at the lower nodes, 25–48 cm tall, the internodes hollow, glabrous, purple, reddish, or green, 0.9–1.7 mm diam. Leaves cauline; sheaths shorter than the internodes, rounded on the back, strongly nerved, the midrib conspicuous, truncate at apex, glabrous to pilose, margins ciliate; ligule a row of stiff trichomes 0.3 mm long; pseudopetiole 0.5–2 mm long; blades ovate to ovate-lanceolate, 30–80 mm long, 8–20 mm wide (length:width ratio 2.8–4.5:1), flat, 80–90 μm thick, glabrous to pilose, the midrib conspicuous on the abaxial surface but inconspicuous adaxially, margins with a thin, sclerified, minutely scabrous nerve 70–160 μm wide. Inflorescence a panicle with 5–14(–18) alternate racemes, the terminal panicle 40–80 mm long, the secondary pan-

3

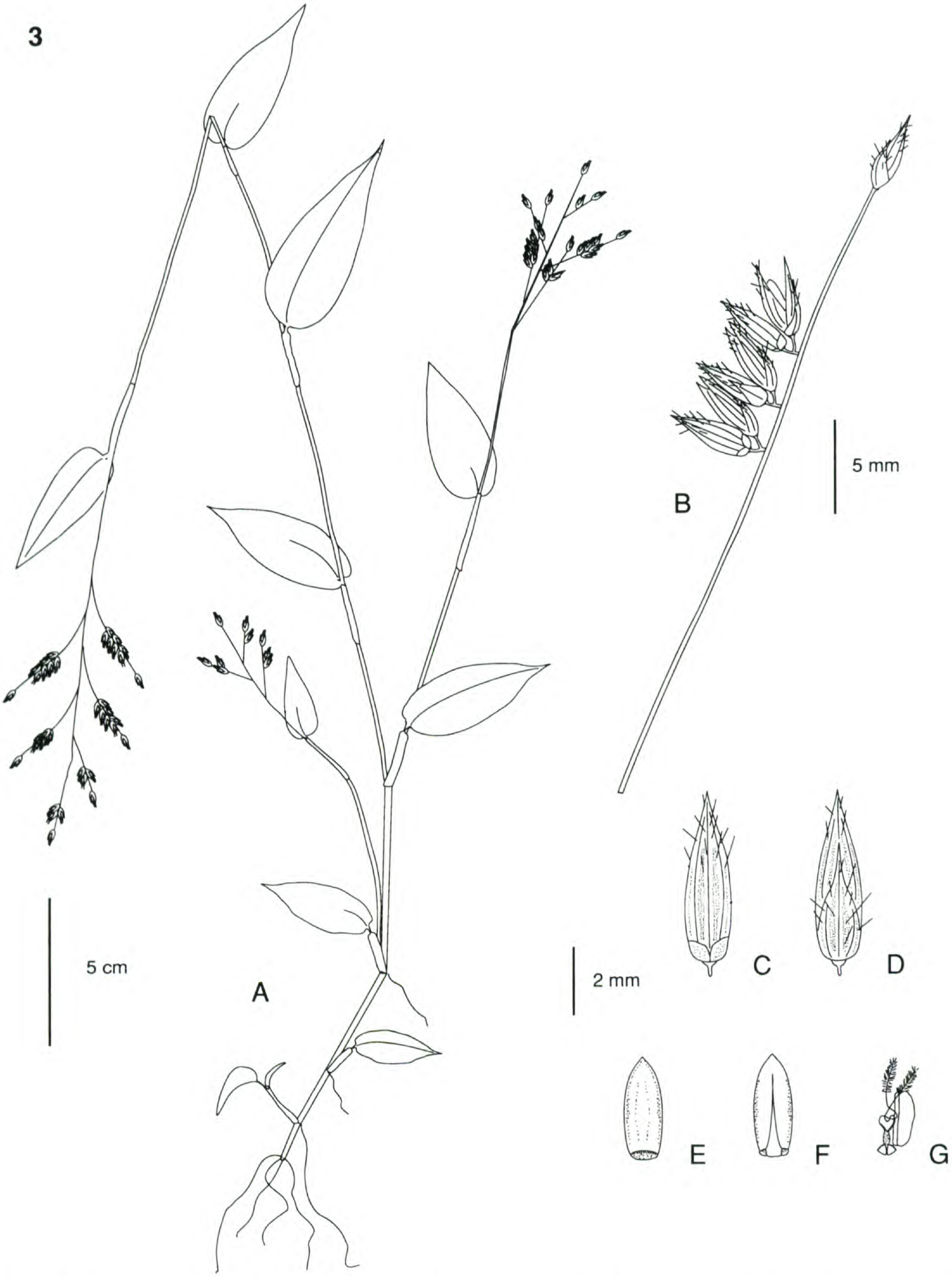


Figure 3. *Ichnanthus annuus* Killeen & Kirpes. —A. Habit, leaves, and inflorescence. —B. Raceme with medial cluster of paired spikelets and solitary terminal, long-pedicellate spikelet. —C. Dorsal view of spikelet. —D. Ventral view of spikelet. —E. Dorsal view of upper floret. —F. Ventral view of upper floret. —G. Flower, showing lodicules, gynoecium, and one (of three) anthers. This drawing was prepared by Tim Killeen with the aid of computer facilities at the ISU printing plant.

icles 3–50 mm long; rachis 10–80 mm long, hirsute, the white hairs 2–5 mm long; racemes glabrous, 20–50 mm long, with a medial cluster of 2–8 paired, secund spikelets on hirsute pedicels 0.5–1.0 mm long, with internodes 1–2.5 mm, and the single, terminal spikelet on a glabrous pedicel 3–8 mm long. Spikelets 3.8–5.0 mm long, narrowly triangular, outer bracts laterally compressed, upper floret dorsally compressed; lower glume ⅔–¾ as long as the spikelet, lanceolate, clasping the spikelet at base, acuminate to short-aristate, sparsely pilose to glabrous, chartaceous, 3-nerved, nerves distinct, midnerve prolonged to form a minute awn 1 mm long; upper glume as long as the spikelet, lanceolate, acuminate, 5-nerved, if pubescent less so than lower glume; lower floret staminate or vestigial, lower lemma similar to the upper glume, palea hyaline, 2.5 mm long, anthers 3, to 2.3 mm long when fertile; upper floret bisexual, 2–2.7 mm long, the lemma elliptical, acute, coriaceous, pale green, shining, glabrous, the margins flat, base with 2 inconspicuous, marginal scars 0.2 mm long connate to an abaxial indurated ridge, palea similar in texture to lemma; anthers 1.2 mm long, purple; styles 2, stigmas plumose, purple, exserted during anthesis; caryopsis 1.5 mm long, 0.6 mm wide, ellipsoidal, tan.

Paratypes. BRAZIL. MARANHÃO: Fazenda Morros, 35 km S of Loreto, 200–300 m, 21 Mar. 1962, *Eiten & Eiten 3719* (F, NY, US), 17 Apr. 1962, *Eiten & Eiten 4319* (F, MO, NY), 22 May 1962, *Eiten & Eiten 4652* (US, NY); 40 km S of Loreto, 10 Feb. 1970, *Eiten & Eiten 10530* (MO); Ilha de Balsas, Picada, 40 km S of Loreto, 250 m, 25 Mar. 1962, *Eiten & Eiten 3829* (F, NY, US); 35 km S of Loreto, 15 Feb. 1970, *Eiten & Eiten 10614* (MO); Fazenda São Raimundo, 30 km S of Loreto, 200–300 m, 6 Apr. 1962, *Eiten & Eiten 4067* (F, NY, US); Fazenda Santa Rita to Fazenda Trabalhosa, 20 km S of Loreto, 200–300 m, 7 Apr. 1962, *Eiten & Eiten 4179A* (NY); Barra do Corda to Graja, *Swallen 3731* (US); Carolina, *Swallen 3892*. COLOMBIA. META: El Mico airstrip (camp 1), last savanna before Río Guejar, 450 m, 6 Nov. 1949, *Philipson et al. 1338* (NY). VENEZUELA. BOLÍVAR: Cedeño, 74 km SW of Caicara del Orinoco, 80 m, 4 Sep. 1985, *Steyermark et al. 131293* (MO); 14 km SE of Caicara along hwy. 19 to Ciudad Bolívar, 160 m, 22 Nov. 1973, *Davidse 4333* (MO, NY). GUÁRICO: Calabozo, Estación Biológico de los Llanos, 6 Aug. 1960, *Aristeguieta 4331* (US), *Aristeguieta 4356* (US); el tranquero del Hector Garido, carretera hacia El Baul, Aug. 1966, *Aristeguieta 6311* (MO); 60 m, 9 Nov. 1971, *Davidse 2913* (ISC, MO); Cerro Veladero, Parque Nacional Aguaro–Guariquito, 200 m, *Delascio et al. 10363* (MO); SSE of Calabozo, 3 Aug. 1983, *Kral 70643* (MO). PORTUGUESA: Araure, Montañas de Palmarito, 8 km NE de Santa Lucia, 800 m, 13 Sep. 1984, *Aymard & Ortega 3018* (ISC, MO).

Flowering occurs from February to May south of the equator and from August to November in the Northern Hemisphere. This species has been encountered in forest, secondary forest, and along forest margins, frequently near seasonal streams and in disturbed areas, in Maranhão, Brazil, and in the Llanos region of Venezuela and Colombia (Fig. 2).

Ichnanthus procurrens (Nees ex Trin.) Swallen, Phytologia 11: 149. 1964. Basionym: *Panicum procurrens* Nees ex Trin., Gram. Panic. 183. 1826. *Echinolaena procurrens* (Nees ex Trin.) Kunth, Révis. Gramin. 1: 54. 1829. TYPE: Brazil. Minas Gerais: "in campis glareosis," *Langsdorf s.n.* (holotype, LE not seen, fragment, US ex LE).

Perennial; caespitose; culms procumbent, rarely decumbent and rooting at lower nodes, branching extravaginally at base; 30–120 cm tall, internodes 0.7–2.0 mm diam., hollow, glabrous, purple, reddish, or green. Leaves cauline; sheaths longer than the internodes below, shorter above, rounded on the back, strongly nerved, midrib often conspicuous, truncate at apex, glabrous to pilose, the margins ciliate; ligule a row of stiff trichomes 0.3–0.6 mm long; blades ovate-lanceolate to lanceolate, 30–60(–80) mm long, 2.0–16 mm wide (length : width ratio 3.1–17.8 : 1), cordate at base, flat, strongly sclerified, 100–170 μm thick, glabrous to pilose, midrib indistinct except at the base on abaxial and adaxial surfaces, margins with a conspicuous, sclerified, scabrous nerve 0.18–0.35 mm wide. Inflorescence a panicle with 5–28 alternate racemes, the terminal panicle 35–150 mm long, the secondary panicles 2–50 mm long; rachis hirsute, the white hairs 0.7–1.2 mm long; racemes glabrous, 15–70 mm long, with 2–7 pairs of spikelets on hirsute pedicels 1–6 mm long and a single, terminal spikelet on a glabrous pedicel 6–14 mm long. Spikelets 3–4.5 mm long, ovate-lanceolate, outer bracts laterally compressed, upper floret dorsally compressed; lower glume ½ to as long as the spikelet, triangular, clasping spikelet at the base, acuminate, chartaceous, 3-nerved, the nerves distinct, pilose to hispid, trichomes 0.5–3 mm long; upper glume as long as the spikelet, lanceolate, blunt to acute, 5-nerved, pubescent but less so than the lower glume; lower floret staminate, lower lemma similar to the upper glume, palea hyaline, 2.7 mm long, anthers 3, 1.5–1.8 mm long; upper floret bisexual, 2–2.7 mm long, lemma elliptical, acute, coriaceous, pale green, shining, glabrous, margins flat, the base with 2 inconspicuous, marginal scars 0.2 mm long, indistinct, connate to an abaxial indurated ridge; palea similar in texture to the lemma; anthers 1.5–1.8 mm long, purple; styles 2, stigmas plumose, purple, exserted during

anthesis; caryopsis 1.5 mm long, 0.6 mm wide, ellipsoidal, tan.

Ichnanthus procurrens (Nees ex Trin.) Swallen var. **procurrens.** *Panicum procurrens* Nees ex Trin. var. *genuinum* Doell in C. Martius, Fl. Bras. 2(2): 272. 1887, name invalid, not an autonym (Greuter et al., 1988). *Panicum procurrens* Nees ex Trin. var. *genuinum* forma *villosum* Doell in C. Martius, Fl. Bras. 2(2): 272. 1887.

Panicum procurrens Nees ex Trin. var. *genuinum* forma *glabratum* Doell in C. Martius, Fl. Bras. 2(2): 272. 1887. TYPE: Brazil. 1814–1820, *Sellow 1249* (lectotype, designated by Stieber (1987), US fragment ex B).

Culms 30–80 cm long, internodes 0.7–1.5 mm diam.; leaf blades lanceolate to linear (length : width ratio 6.2–17.8 : 1). Panicles 35–70 mm long; racemes 5–10(–18), each with a medial cluster of 2–5 paired spikelets separated by internodes 1–2.5 mm long, pedicels unequal, 0.5 mm long and 1.5–3.0 mm; spikelets 3–3.9 mm long, lower glume ½ to ¾ as long as the spikelet; apex of upper glume and lower lemma blunt; upper floret 2.0–2.5 mm long.

Selected specimens examined. BOLIVIA. SANTA CRUZ: Sara, Buena Vista, 500 m, 17 Feb. 1921, *Steinbach 7012* (F, MO, NY); Ñuflo de Chavez, Estancia Santa María, 5 km S of Concepción, 480 m, 21 Jan. 1986, *Killeen 1642* (F, ISC, MO); Estancia Salta, 10 km SE of Concepción, 490 m, 8 Jan. 1987, *Killeen 2285* (F, ISC, MO); Velasco, 10 km E of Santa Rosa de la Roca, 400 m, 22 Jan. 1985, *Killeen 776* (F, ISC, MO). BENI: Ixiamas, 300 m, 13 Dec. 1921, *Cárdenas 1909* (F, NY); Mamoré, 2 mi. S of San Joaquin, 7 Mar. 1964, *Tyson & Kuns 951* (MO); Yacuma, Estación Biológica del Beni, 200 m, 18 July 1987, *Killeen 2590* (US). BRAZIL. BAHIA: Espigão Mestre, 100 km WSW of Barreiras, 750 m, 5 Mar. 1972, *Anderson et al. 36619* (F, MO, NY, US). DISTRITO FEDERAL: E of Lagoa Paranoâ, 975 m, 10 Dec. 1967, *Irwin et al. 11167* (F, MO, NY); Reserva Ecol. do IBGE-DF, 3 Dec. 1981, *Filgueras 942*, (US). GOIÁS: Annapolis, 1,000 m, 18 Mar. 1930, *Chase 11347* (US); 25 km S of Niquelândia, 750 m, 24 Jan. 1972, *Irwin et al. 34970* (MO, US); Serra do Rio Preto, 8 km E of Cabeceiras, 18 Nov. 1965, *Irwin et al. 10445* (F, MO, NY, US); Goiânia, 1,000 m, 20 Mar. 1930, *Chase 11415* (F, MO, US); Chapada dos Veadeiros, 8 km NW of Veadeiros on road to Cavalcante, 1,200 m, 22 Oct. 1965, *Irwin et al. 9496* (F, NY, US); Serra dos Pirineus, 21 km E of Pirenópolis, 1,000 m, 16 Jan. 1972, *Irwin et al. 34381* (F, MO, NY, US). MARANHÃO: Carolina to San Antonio de Balsas, 20–25 Mar. 1934, *Swallen 4019* (US); Grajahu to Porto Franco, 8–13 Mar. 1934, *Swallen 3791* (US). MATO GROSSO: Rio Sangrador prope Cuyabá, 9 Dec. 1893, *Lindman 2575* (US); 85 km N of Xavantina, 2 June 1966, *Hunt & Ramos 5727* (NY, US); 209 km NNE of Xavantina, Landicos Restaurant, *Eiten & Eiten 9821* (US). MATO GROSSO DO SUL: Tres Lagoas, 300–325 m, 4 Feb. 1930, *Chase 10724* (F, US); Corumbá, Niquelândia, 19 Nov. 1977, *Allem & Vieira 1355* (MO); Paiaguás, Fazenda Santana, 18 June 1977, *Allem & Vieira 938* (MO); Fazenda Santo Estevão, 14 Dec. 1977, *Allem & Vieira 1190* (MO); Cáceres, Fazenda Descalvados, 5 Nov. 1978, *Allem et al. 2430* (MO). MINAS GERAIS: São Miguel, NW of Formiga, 600–625 m, *Chase 10554* (US); Lavras, 6 Mar. 1925, *Chase 8743* (F, NY, MO); Faria, Serra da Bocaina, 100–1,200 m, 9 Jan. 1930, *Chase 10554* (F, MO, NY); Burity s, near Rio São Francisco, 1 Jan. 1930, *Chase 10451* (US); Belo Horizonte, Vila Progresso, 10 Jan. 1940, *Magalhães 1* (US); Serra do Cabral, 2.5 km W of Cantoni, 850 m, *Irwin et al. 27278* (F, MO, NY). PARÁ: Serra do Cachimbo, 425 m, 16 Dec. 1956, *Pires et al. 6354* (NY, US); Munic. Conceição do Araguaia, 20 km W of Redenção, 350–620 m, *Plowman et al. 8724* (NY, US); 4 km W of Redenção on PA-150, 200 m, 21 Feb. 1980, *Plowman et al. 8986* (MO, NY, US). SÃO PAULO: Itapetininga, Sorocaba, 600 m, 4 Feb. 1965, *Clayton 4513* (NY, US); Itapetininga, 11 Dec. 1887, *Loefgren s.n.* (US); Ypiranga, Dec. 1910, *Luederwaldt 9923* (NY, US) Yti, 20 Oct. 1897, *Russel 35* (US). PARAGUAY. In regione cursus superioris fluminis Apa, *Nor 7818* (MO, NY).

Flowering from December to June. Occurring throughout central Brazil and eastern Bolivia (Fig. 3). This species most commonly occurs in the seasonally humid microhabitats of valley-side campos and pantanal complexes; it is less common in seasonally inundated savanna and rarely occurs in well-drained cerrado savanna. Specimens from Pará and northern Mato Grosso are intermediate to *I. annuus*; *I. procurrens* var. *procurrens* intergrades with the subsequent variety.

Ichnanthus procurrens var. **subaequiglume** (Hackel) Killeen & Kirpes comb. nov. Basionym: *Panicum procurrens* var. *subaequiglume* Hackel in E. Ekman, Ark. Bot. 13: 30. 1933. TYPE: Brazil. Capão Grande, 22 Mar. 1904, *Dusén 3992a* (lectotype, designated by Stieber (1987), W; isolectotype, US; syntype (Stieber, 1987), Brazil, Paraná, Rio Tibagy, 17 Jan. 1909, *Dusén 7537*, US).

Culms 60–120 cm long, middle internodes 1.2–2.0 mm diam.; leaf blades ovate-lanceolate to lanceolate (length : width ratio 3.1–11.5 : 1). Panicles 80–150(–163) mm long; racemes (7–)10–28; paired spikelets separated by internodes (2–)4–8 mm long, pedicels unequal, 1–2.5 mm and 3–7 mm long; spikelets 3.5–4.0(–4.5) mm long, lower glume subequal to or surpassing the other spikelet bracts; apex of upper glume and lower lemma blunt to acute; upper floret 2.5–3.0 mm long.

Selected specimens examined. ARGENTINA. CORRIENTES: Santo Tomé, Estado Garruchos, 12 Feb. 1960, *Pedersen 5419* (MO); Itazaingo, Ruta 12, 4 km from provincial boundary, 20 Jan. 1975, *Pedersen 10685*

(MO); 5 km E de Gobernador Virasoro, 13 Apr. 1985, *Zuloaga et al. 2330* (MO). MISIONES: Posadas, Santa Inés, 4 Feb. 1922, *Parodi 4539* (US); Concepción, 28 Jan. 1926, *Parodi 6942* (US); San Ignacio, 14 Feb. 1946, *Montes 1921* (F, MO, US); Candelaria, Loreto, 25 Feb. 1946, *Montes 1942* (MO); Cainguas, 270 m, 13 Mar. 1958, *Montes 27639* (F, MO, NY, US). BRAZIL. GOIÁS: Annapolis, 1,000 m, 18 Mar. 1930, *Chase 11384* (MO, US), *Chase 11386* (MO, US); Santa Rita do Paranahyba, 500 m, 31 Mar. 1930, *Chase 11665* (US); 12 Apr. 1930, *Chase 11981* (US), *Chase 11989* (US). MATO GROSSO: between Rondonopolis and São Lourenço, 9 Apr. 1930, *Chase 11928* (US). MATO GROSSO DO SUL: Campo Grande, 540 m, 7 Feb. 1930, *Chase 10783* (F, MO, NY, US); Aquiduana, 181 m, 26 Feb. 1930, *Chase 11047* (US). MINAS GERAIS: Ituitaba, Pilloeõs, 20 Jan. 1957, *Macedo 4879* (US). PARANÁ: Munic. Balsa Nova, Rio Papagaios, BR-277, 14 Jan. 1981, *Hatschbach 43500* (US); Serrinha, 2 Mar. 1916, *Dusén 17677* (F, MO); Vila Velha, Ponta Gossa, 10 Jan. 1977, *Dombrowski 6901* (US); 13 km NE of Atuba, near Curitiba, 890 m, 9 Mar. 1976, *Davidse et al. 10962* (MO). RIO GRANDE DO SUL: São Francisco, Vila Oliva, 28 Dec. 1945, *Rambo 30734* (US). SANTA CATARINA: Morro do Pinheiro, 1,000 m, 4 Feb. 1963, *Reitz 6615* (NY); Campos Novos, 800–900 m, 9 Feb. 1957, *Smith & Klein 11908* (NY). PARAGUAY. Ypacaraí, *Hassler/Lam 12461* (F, MO, NY, US); Misiones, San Ignacio, 16 Feb. 1950, *Rosengurtt 5789* (F); Estado La Soledad, 3 km S de Santiago, 3 Feb. 1988, *Schinini & Vanni 26086* (MO); Cordillera de Altos, *Fiebrig 961* (F); Amambay, parque nacional Cerro Corá, NE of Park headquarters, 10 Feb. 1982, *Solomon et al. 6852* (MO); "In regione cursus superioris fluminis Apa," 1902, *Hassler/Lam 8383* (NY).

Flowering from January to March. Occurring in cerrado and other well-drained savanna formations in northeastern Argentina, Paraguay, and southern Brazil (Fig. 2). This taxon intergrades with *I. procurrens* var. *procurrens* for several characters (Fig. 1, Table 1). The leaf blade anatomy of this taxon is most similar to *I. annuus* (Kirpes et al., in prep.), and populations in Mato Grosso have ovate leaf blades like those found in the annual species. The inflorescence morphology is similar to *I. camporum*, and Swallen (1964) suggested that two specimens from Goiás (*Chase 11384* and *Chase 11386;* see arrow, Fig. 1) may be the result of hybridization between *I. procurrens* and *I. camporum*.

Ichnanthus camporum Swallen, Phytologia 11: 142. 1964. TYPE: Brazil. Goiás: between Viannópolis and Ponta Funda, sandy clay campo, 990–1,000 m, 17 Mar. 1930, *Chase 11274* (holotype, US; isotype, US).

Panicum procurrens var. *solutum* Doell in Martius, syn. nov. Fl. Bras. 2(2): 272, 1877. TYPE: Brazil, Corgofundo ante S. José, *Pohl 2162* (holotype, W; isotype, US).

Perennial from stout, bracteate rhizomes 1–3 cm long; culms 60–87(–110) cm long, freely branched, the internodes hollow, 1.5–2.2 mm diam., setose, purple or reddish in color. Leaves cauline; sheaths longer than the internodes below, shorter above, rounded on the back, strongly nerved, midrib conspicuous, setose to velutinous, rarely pilose, margins membranous; ligule a row of stiff trichomes 0.5–0.7 mm long; leaf blades lanceolate to linear (length : width ratio 8.9–24.9 : 1), attenuate at base, flat, strongly sclerified, 0.10–0.30 mm thick, hirsute (glabrous), the midrib conspicuous on both the abaxial and adaxial surfaces, margins with a conspicuous sclerified, scabrous nerve 0.21–0.30 mm wide. Inflorescence a panicle of 7–20 alternate racemes, each 44–80 mm long; panicles several, borne on short leafy branches originating at upper nodes; terminal panicle 100–180 mm long, rachis glabrous, 20–80 mm long, spikelets solitary or paired, distally placed on hirsute pedicels 1–3 mm long, internodes between pairs 5–9 mm long, the solitary terminal spikelet on a glabrous pedicel 3–9 mm long. Spikelets 4.4–5.5 mm long, ovate, green or purple, outer bracts laterally compressed, upper floret dorsally compressed; lower glume ⅔–¾ as long as the spikelet, lanceolate, clasping the spikelet at the base, acute, glabrous, chartaceous, 3-nerved, the nerves distinct; upper glume as long as the spikelet, lanceolate, acuminate, 5-nerved, glabrous; lower floret staminate, rarely vestigial, lower lemma similar to the upper glume, the palea hyaline, 3 mm long, anthers 3, to 2.5 mm long when fertile; upper floret bisexual, 3.0–3.7 mm long, lemma elliptical, acute, coriaceous, pale green, shining, glabrous, the margins flat, the base with 2 inconspicuous, marginal scars 0.2 mm long, connate to an abaxial indurate ridge, palea similar in texture to the lemma; anthers 2.2 mm long, purple; styles 2, the stigmas plumose, purple, exserted during anthesis; caryopsis not seen.

Selected specimens examined. BRAZIL. DISTRITO FEDERAL: Universidade da Brasília, 23 Feb. 1965, *Clayton 4796* (US); Chapada da Contagem, 10 km E of Brasília, 1,100 m, 12 Jan. 1966, *Irwin et al. 11582* (MO, US), 14 Jan. 1966, *Irwin et al. 11667* (MO, US); between Brasília and Sobradinho, 1,000 m, 13 Oct. 1965, *Irwin et al. 9161* (MO, US).GOIÁS: between Viannapolis and Ponta Funda, 900–1,000 m, 17 Mar. 1930, *Chase 11336* (US); Serra dos Pirineus, 20 km E of Pirenópolis, 1,000 m, 14 Jan. 1972, *Irwin et al. 34087* (MO, US), *Irwin et al. 34142* (MO); Chapada dos Veadeiros, 1,050 m, 22 Oct. 1965, *Irwin et al. 9490* (MO, US). MINAS GERAIS: Serra do Espinhaço, 17 km SW of Gouveia on Mato Grosso 259, 1,000–1,050 m, 7 Feb. 1972, *Anderson et al. 35585* (MO, US).

Flowering from January to April. Occurring in sandy, well-drained soils or on rocky talus slopes above 900 m. Specimens from Goiás and the Distrito Federal have distinctly velutinous foliage, but var-

iants from Minas Gerais and Rio de Janeiro are glabrous. A nomenclatural irregularity was discovered in the course of the study. Stieber (1987) stated that the name *P. procurrens* var. *solutum* was used by Doell (1877) to refer to the grasses recognized here as *I. annuus*. The holotype, which he had not seen, has stout rhizomes, nonclustered spikelets, and other attributes common to *I. camporum*.

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Appendix. Characters used in the principal components analysis; coding method is in parentheses.

Annual/perennial (0/1); rhizomatous (0/1); rooting at the lower nodes (0/1); culm diameter (mm); length of the leaf blades (mm); width of the leaf blade (μm); length : width ratio of leaf blade (number); mesophyll cells between bundle sheath cells (number); distance between bundle sheaths (μm); density of chloroplasts in bundle sheath cells (0–2); veins/leaf blade at the middle of blade (number); diameter of sclerified marginal nerve (μm); vestiture of sheath, glabrous to velutinous (0–5); vestiture of throat (0–5); vestiture of abaxial surface of leaf blade (0–5); vestiture of adaxial surface of leaf blade (0–5); length of infloresence (mm); length of longest raceme (mm); number of racemes (number); spikelets/raceme (number); total spikelets (number); length of raceme internodes (mm); length of terminal pedicel (mm); length of spikelet (mm); lower glume : spikelet ratio (number); apex of lower glume, blunt to acuminate (0–2); apex of upper glume (0–2); apex of lower lemma (0–2); length of upper floret; vestiture of lower glume, glabrous to densely pilose (0–3); vestiture of upper glume (0–3); vestiture of lower lemma (0–3).

Panicum aquarum, a New South American Species of *Panicum* (Poaceae: Panicoideae: Paniceae)

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Previously unidentified specimens from Brazil, Colombia, and Venezuela are recognized as a new species of *Panicum*. This species is described and illustrated exomorphologically and anatomically and is compared with the putative most closely related species in subgenus *Panicum*. *Panicum aquarum* has a peculiar inflorescence pattern, with prophyllar branching occurring in several parts of the inflorescence. Prophyllar branching has not been cited up to the present in the genus *Panicum* and is an uncommon feature of the Poaceae.

Materials and Methods

Segments taken from the middle third of the second leaf blade of a floriferous culm were used for anatomical studies. Specimens were treated with Contrad 70 (Schmid & Turner, 1977). The leaf material was desilicified, free-hand sectioned, stained with safranin and fast green, and mounted in glycerin jelly. Epidermis preparations were made following Metcalfe's (1960) method. Silica bodies, cork cells, and starch grains were identified with liquid phenol (Metcalfe, 1960), Sudan III (Sass, 1940), and I_2K (Sass, 1940) respectively. Drawings and observations were made using a Willd M20 microscope with camera-lucida. Upper anthecia were studied with a JEOL, J.S.M. 25SII scanning electron microscope (SEM) of the Department of Odontology of the University of Buenos Aires, Argentina.

Panicum aquarum Zuloaga & Morrone, sp. nov. TYPE: Venezuela. Guárico: Dpto. Infante, Parque Nacional Aguaro-Guariquito, Congriales de la Gorra, entre La Esperanza y Mesa de Cambao, ca. 9°12′–9°16′N y 67°48′–67°60′W, 60 m, Dec. 1981, *Delascio, Montes & Davidse 11206* (holotype, VEN; isotypes, MO, SI). Figures 1, 2.

Culmi 0.90–1.30 m alti, paniculis numerosis ex nodis superioribus nascentibus, spiculis elipsoideis 3–3.9 mm longis, gluma inferiore spiculae ½–¾ longitudinis aequante, gluma superiore ac lemma inferiore subaequalibus, anthoecio superiore indurato, glabro, brevi, paleae apice papilloso.

Annual?, 0.90–1.30 m high. *Culms* erect, rooting at the lower nodes, freely branching at the upper nodes; internodes 7–19 cm long, glabrous, striate, mottled, hollow; nodes glabrous, compressed, brownish. *Sheaths* 8–18 cm long, thin, delicate, glabrous, shiny on the inner surface and with air spaces, the margins membranous. *Ligules* ca. 1.2 mm long, short-membranous at the base and long-ciliate at the apex, adaxial surface pilose; collar glabrous. *Blades* linear, 11–18 cm long, 0.2–0.4 mm wide, the lower ones deciduous, glabrous, narrowed at base, the margins involute, scaberulous, the midnerve manifest toward the base. *Inflorescence* terminal with a peduncle up to 25 cm long, glabrous, scaberulous; *panicles* lax, pyramidal, multiflowered, 35–40 cm long, 12–20 cm wide; axillary panicles numerous, smaller and similar to the terminal one; *main axis* terete, glabrous, the pulvini glabrous; first-order branches alternate or subopposite, divergent, the axis of the branches triquetrous, scaberulous; second- and third-order branchlets alternate with scaberulous axis; spikelets congested on third-order branches; pedicels claviform, glabrous. *Spikelets* solitary, ellipsoid, 3–3.9 mm long, 1–1.2 mm wide, glabrous, stramineous or tinged with purple, gaping at maturity; upper glume and lower lemma subequal, acuminate, longer than the upper anthecium. *Lower glume* ovate, abruptly acuminate, 1.7–2.7 mm long, ½–¾ the length of the spikelet, (3–)5-nerved, the midnerve scaberulous toward the upper portion; stipe conspicuous between the lower and upper glume. *Upper glume* 3–3.6 mm long, acuminate, (5–)7-nerved. *Lower lemma* glumiform, 3–3.2 mm long, (5–)7-nerved. *Lower palea* oblong-lanceolate, 1.7–2.1 mm long, 0.6–1 mm wide, glabrous, hyaline; lower flower absent. *Upper anthecium* ellipsoid, 2.1 mm long, 1.2–1.3 mm wide, indurate, stramineous, with black spots at maturity, smooth and shiny, with a brown disc at its base at maturity; upper lemma 5-nerved, the margins involute; upper palea 2-nerved, papillose at the apex. *Caryopsis* broadly ellipsoid, 1.5 mm long, 1 mm wide, whitish; hilum subbasal, punctiform; embryo ⅓ or less the length of the caryopsis.

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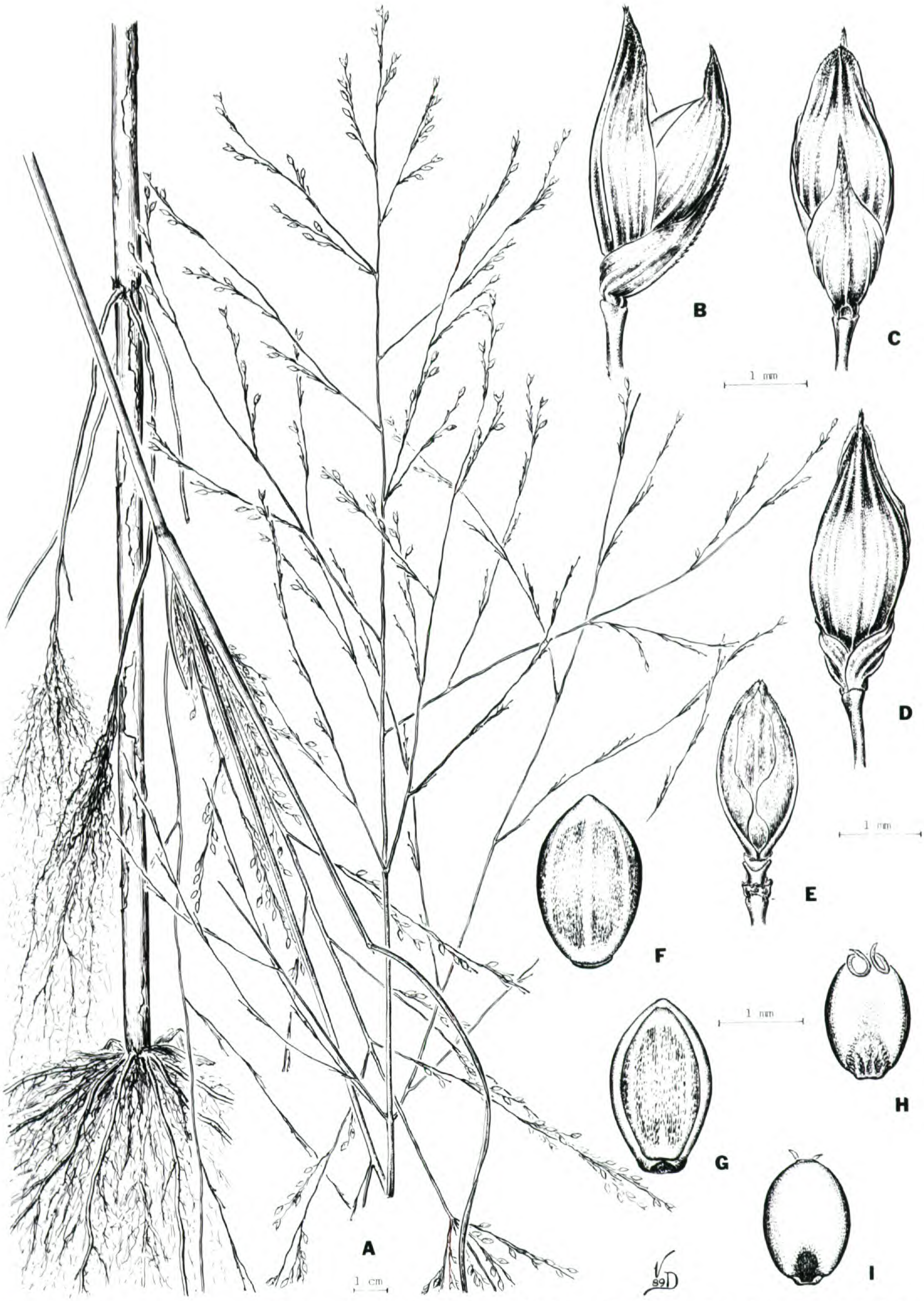

Figure 1. *Panicum aquarum* (*Blydenstein 1846*, COL). —A. Habit. —B. Spikelet, lateral view. —C. Spikelet, ventral view. —D. Spikelet, dorsal view. —E. Lower palea. —F. Upper anthecium, dorsal view. —G. Upper anthecium, ventral view. —H. Caryopsis, embryo side. —I. Caryopsis, hilum side.

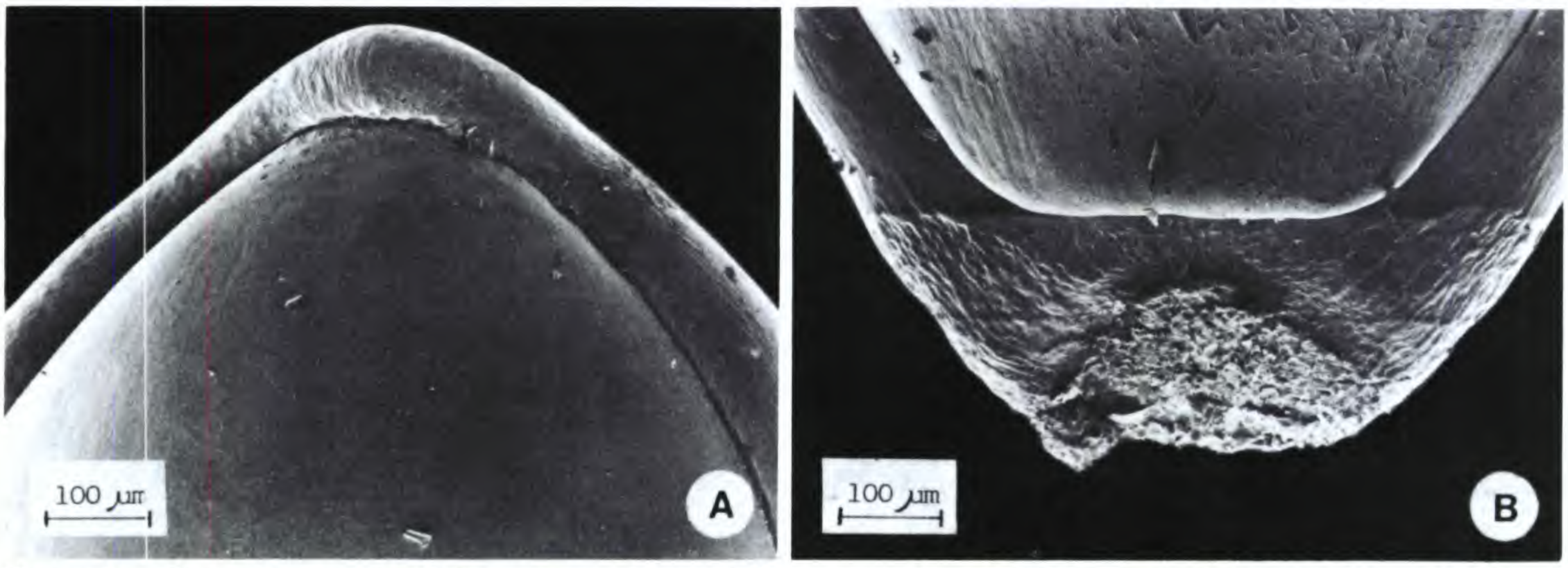

Figure 2. Photomicrographs of the upper anthecia of *Panicum aquarum* (*Delascio et al. 11206*, SI). —A. Upper portion of the lemma and palea, palea with papillae at the apex. —B. Lower portion of the upper anthecium.

estrada 319 ao norte da estrada, entre igarapés Retiro e Bom Futuro, 70 m, 11 May 1980, *Gemtchujnicov & Janssen 369* (IBGE, SP). PARA: Marajó, Camará River, Sep. 1902, *without collector* (US 1024781); ad Tocantins flumen inter Porto Imperial et Funil, *Burchell 8813* (K, W). COLOMBIA. META: Lago Carimagua, altillanura plana, bajo 30 cm de agua, 19 Nov. 1963, *Blydenstein 1846* (COL, G).

The specific epithet refers to the aquatic habitat of the species.

Burchell 8813 was included by Doell (1877) as a syntype of *P. virgatum* L. var. *glabrum*, together with *Vinzent 3* from the United States. *Panicum virgatum* L. grows in the United States, Mexico, and the West Indies; it differs from *P. aquarum* in having conspicuous rootstocks and rigid culms with a single terminal inflorescence.

Panicum aquarum inhabits inundated areas of the "Provincia Amazonica" and "Provincia de la Sabana" (Cabrera & Willink, 1973), both provinces having a rainy season in which many areas are covered by water. The type specimen was collected, according to the label, under 1.30–1.80 m of water.

This species has conspicuous aerial roots from the lower nodes of the culms. Blades are usually missing in the lower portion of culms; the sheaths are delicate and spongy when young and the sheaths that remain are laciniate at maturity. Sheaths and the lower portion of blades have conspicuous lacunae between contiguous vascular bundles, and lacunae are also present in the roots.

The presence of lacunae in roots, sheaths, and blades indicates that these plants are adapted to aquatic or semiaquatic habitats with a low availability of oxygen.

Panicum aquarum has a complex system of floriferous culms (Fig. 3). The main culm develops in a terminal inflorescence on a long peduncle. At the base of the main inflorescence is a bud which develops in a secondary inflorescence. This lateral floral branch has a 2-keeled prophyllum, with the keels embracing the new branch. Distal to the first node of the lateral branch, and separated by a clear internode, is another node that bears a completely developed sheath and blade. Successive axillary inflorescences continue the same pattern, and each branch ends in an inflorescence similar to the terminal one, except that it is smaller. A peculiar feature of *Panicum aquarum* is the presence of prophylls with a bud in their axil, which usually develops into a branch (Fig. 3). Thus, a prophyll is the first bract on each side branch, and this pattern is repeated throughout the entire inflorescence. This kind of branching pattern was called prophyllar branching by Meert & Goetghebeur (1979) and is, as these authors mentioned, a common feature in the Cyperaceae. However, the presence of prophyllar branching in the Poaceae is quite uncommon; prophyllar branching was described and illustrated by Cámara Hernández & Gambino (1990) in the genus *Zea;* also, a similar prophyllar branching was illustrated by Davidse & Ellis (1987) for the inflorescence of *Arundoclaytonia*.

LEAF BLADE ANATOMY (FIGURE 4)

LEAF IN TRANSVERSE SECTION

Outline: V-shaped, moniliform. *Ribs and furrows* conspicuous, leaf thickness 130–165 µm on ribs, 40–78 µm on furrows, adaxial ribs obtuse to flat-topped, abaxial ribs obtuse, adaxial furrows up to ½ the width of the blade, the abaxial ones less pronounced; ribs associated with all vascular bundles. *Median vascular bundle:* no midrib or keel developed; median vascular bundle structurally indistinguishable from lateral first-order vascular bundles. *Vascular bundle arrangement:* 6–8 first-order

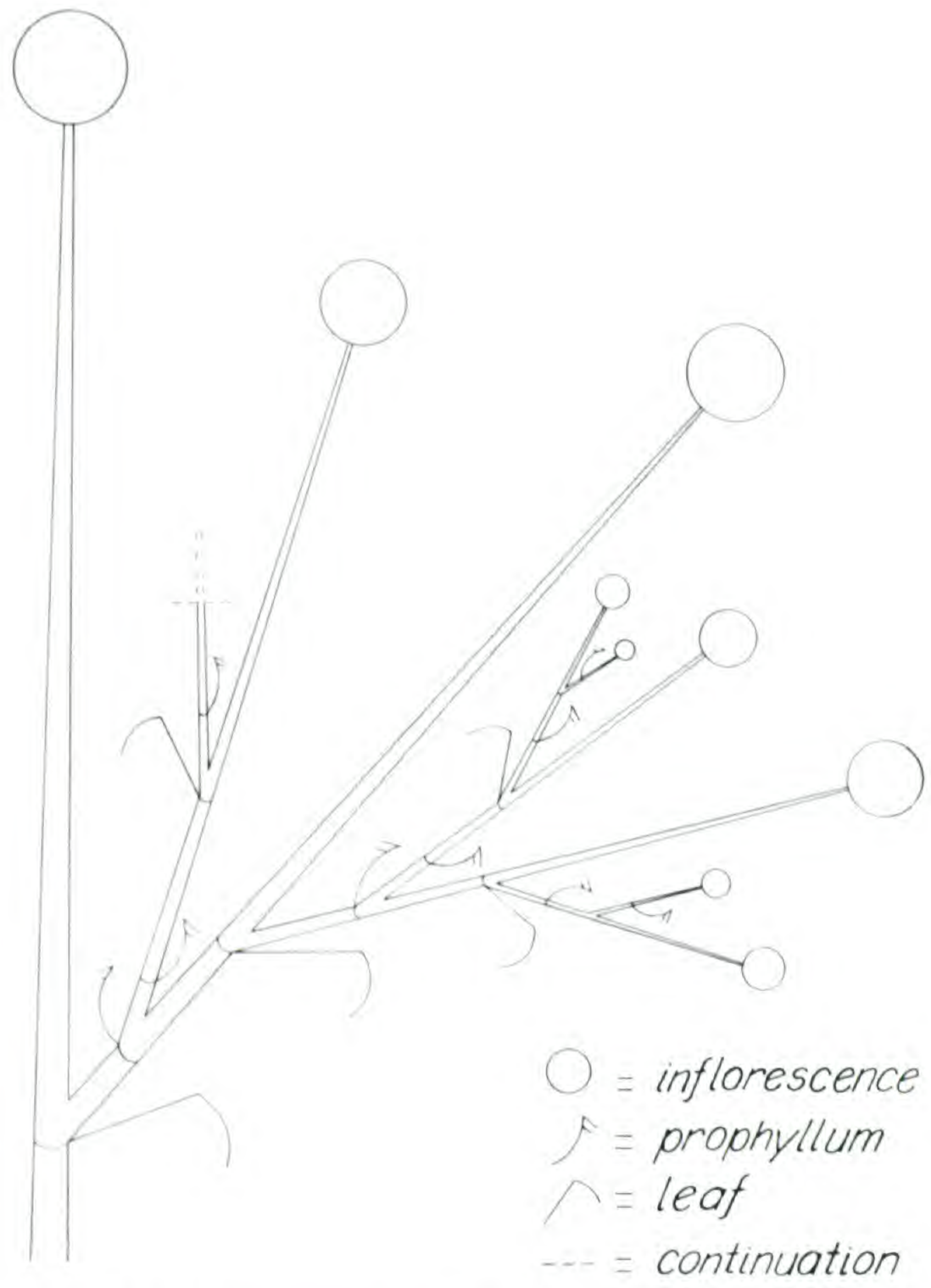

Figure 3. Diagrammatic illustration of a portion of the inflorescence of *Panicum aquarum*.

vascular bundles and 14–16 second-order vascular bundles per leaf section; 2 mesophyll cells between contiguous vascular bundles, with a distance of 110–170 μm between contiguous vascular bundles. *First-order* vascular bundles situated in center of blade, surrounded by an outer Kranz sheath subcircular in outline, regular, abaxially interrupted by sclerenchyma or colorless parenchyma girders; Kranz cells 8–13, the walls thickened, with their radial and inner tangential walls straight; specialized chloroplasts centripetal?; inner mestome sheath complete. Adaxial and abaxial sclerenchyma girders associated with all first-order vascular bundles. *Second-order* vascular bundles situated in center of blade, the Kranz outer sheath rounded in outline, with (5–)6–8 cells; inner mestome sheath present or absent, when present situated toward the abaxial surface and near the phloem. Adaxial and abaxial sclerenchyma girders or strand associated with second-order vascular bundles. *Mesophyll:* chlorenchyma radiate with a single layer of cells around the vascular bundles, continuous or interrupted above and below by sclerenchyma or colorless parenchyma girders; chlorenchyma cells tabular, rachimorphous, with a few intercellular air spaces. Groups of 2–3 fan-shaped *bulliform* cells present at bases of adaxial furrows. *Colorless parenchyma* cells present below furrows, uniseriate and extending to the opposite epidermis. *Epidermal cells* thickened, with a thick cuticle 6.5–10 μm wide on both surfaces; papillose epidermal cells present, associated with ribs. Crystals absent. Kranz sheath with amyloplasts.

ABAXIAL EPIDERMIS

Costal zones with 3–5 files of cells. Silica bodies dumbell-shaped, alternating with 1–2 square to rectangular cork cells, the latter with sinuous walls; prickles not observed. *Intercostal zones* narrow, 6–9 cells wide, long cells rectangular in shape, with sinuous walls, more than three times as long as wide, alternating with short cells; *short cells* in intercostal zones solitary or paired; *cork cells* square to rectangular in shape, with crenate walls; silica bodies irregular in outline. *Stomatal complex* dome-shaped, 32.5–36.4 μm long, 13–18.2 μm wide, in one row on both sides of the costal zones. *Microhairs* 2-celled, 50–58 μm long; walls of basal cell parallel, thicker than walls of distal cells, apex of distal cell obtuse. Hooks occasionally present. Macrohairs not seen. Papillae absent.

Discussion and Conclusions

The presence of two sheaths around the vascular bundles, the outer one with specialized chloroplasts, radiate chlorenchyma, and two cells between contiguous vascular bundles indicates that *P. aquarum* is a C_4 species (Ellis, 1977; Hattersley, 1987).

The chloroplast position on the outer Kranz sheath is dubious because it was not possible to study fresh material of the species. However, there is a tendency to a disposition toward the inner tangential wall.

According to Ellis (1977), *P. aquarum* is a C_4 species of the NAD anatomical subtype, because the outer Kranz sheath is regular in outline and the Kranz cells have straight inner tangential and radial walls.

The exomorphology and anatomy of *P. aquarum* indicate that the species belongs to subgenus *Panicum;* however, it does not have close relatives in this subgenus. It was not possible to assign the species to a section, because of the following reasons.

Panicum aquarum shares a similar habitat and habit with species of section *Dichotomiflora*, e.g., *P. dichotomiflorum* Michaux, *P. elephantipes* Nees ex Trin.; conspicuous air spaces are present in *P. elephantipes*, a common species of rivers or lakes from Mexico to Argentina. However, *P. aquarum* differs from species of section *Dichotomiflora* in having spikelets gaping at maturity, with the lower glume ½–¾ the length of the spikelet. In contrast, in species of section *Dichotomiflora* the spikelets

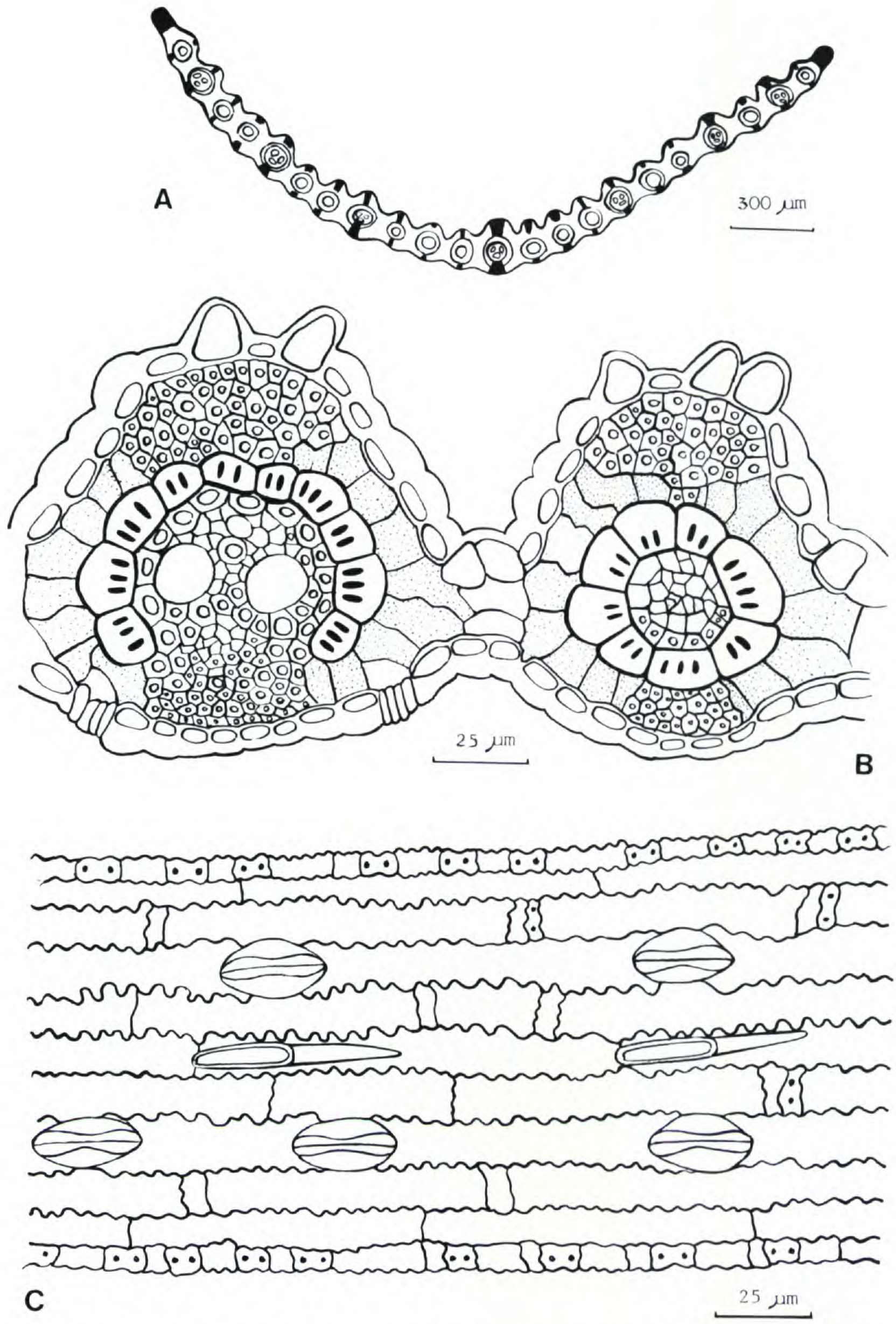

Figure 4. Leaf blade anatomy of *Panicum aquarum* (*Blydenstein 1846*, COL). —A. Outline showing absence of a keel. —B. Transverse section detail showing first- and second-order vascular bundles, bulliform cells with associated colorless cells. —C. Abaxial epidermis showing costal and intercostal zones.

do not gape at maturity and the lower glume is ¼–⅓ the length of the spikelet. In addition, all species of this section have a PCK anatomical Kranz subtype (Ohsugi & Murata, 1986; Ohsugi et al., 1982; Zuloaga, 1987; Ellis, 1988), and also lack colorless parenchyma cells and conspicuous papillae on the epidermis.

Panicum aquarum is similar to species of sections *Repentia* and *Panicum* in its spikelets, which gape at maturity, and in the length of the lower glume. It differs from species of both sections in its habit and habitat. Species of section *Repentia* are perennials with conspicuous rootstocks at the base, and the culms are erect and rigid; species of section *Panicum* are caespitose annuals or perennials of open and dry habitats.

Species of section *Urvilleana* grow in sand dunes and have rigid, infolded leaves, pilose spikelets, and an upper anthecium with long macrohairs at the base of the lemma. Species of section *Rudgeana*

are caespitose, with the upper anthecium conspicuously stipitate at its base.

Acknowledgments. We express gratitude to Gerrit Davidse for critical review of the paper, to Bruno Manara for assistance with the Latin diagnosis, and to Vladimiro Dudás for the illustrations. The first author thanks the Guggenheim Foundation for a fellowship that allowed him to conclude this paper at the Missouri Botanical Garden.

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Panicum tepuianum (Poaceae: Paniceae), a New Species from Cerro Aracamuni in the Venezuelan Guayana

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Recently, 27 new taxa were described from Cerro Aracamuni, a sandstone table mountain (tepui) in southern Venezuela (Steyermark et al., 1989). Most of the new taxa were based on the collections made by R. Liesner, G. Carnevali, and F. Delascio. The present report adds an additional endemic species to the already impressive list known from this mountain massif.

Panicum tepuianum Davidse & Zuloaga, sp. nov.
TYPE: Venezuela. Territorio Federal Amazonas: Depto. Río Negro, Cerro Aracamuni, summit, Proa Camp, savanna with small to large patches of forest, especially among streams, in ravines and near the edge of tepui, in savanna, 01°32′N, 65°49′W, 1,400 m, 30 Oct. 1987, *R. Liesner & G. Carnevali 22645* (holotype, MO; isotype, VEN). Figures 1, 2.

Gramen perenne. Folia plicata et amplectia basin versus; collum non manifesta abaxiale; ligula 0.3–0.6 mm longa, arcuata, membranacea. Panicula ovoidea, 16–18 cm longa. Spiculae 1.8–2.4 mm longae; gluma inferna ca. ⅘ longitudinis spiculae aequans, 3-nervia; gluma superna et lemma infernum 5-nervia; flosculus infernus staminatus; flosculus supernus bisexualis; lemma supernum et palea superna pubescens.

Caespitose perennial to ca. 90 cm tall. *Culms* erect, unbranched (except when injured), with 5–19 elongated internodes; internodes glabrous, hollow, mostly covered by leaf sheaths; nodes dark, appressed-pubescent with hairs to 1.5 mm long. *Sheaths* strongly distichous, abaxially glabrous, ciliate with hairs to 4.5 mm long, especially on the overlapping margin, weakly auricled, the auricles to 2 mm long, membranous, pilose. *Ligule* 0.3–0.6 mm long, membranous, strongly arcuate; collar not evident abaxially. *Blades* lanceolate, 18–21 mm long, 6–8.5 cm wide, stiff, diverging from the culm at an acute angle, basally nearly as broad as the sheath, folded and clasping the culm, apically sharply acute, flattened, abaxially glabrous, adaxially with a few long hairs toward the base, marginally ciliate at the base. *Inflorescence* terminal, exserted; peduncle glabrous, up to 25 cm long; panicle ovoid, open, 16–18 cm long, ca. 10 cm wide; *main axis* wavy, glabrous, the pulvini glabrous; first-order branches solitary, ascending to spreading, scabrous or glabrous, the lowest to 10 cm long; pedicels much longer than the spikelets, 3–15 mm long, scabrous or glabrous, claviform. *Spikelets* elliptic, 1.8–2.4 mm long, 2-flowered, disarticulating below the lower glume, falling as a unit, dorsally compressed, prominently nerved; glumes and lower lemma glabrous or with a few hairs near the apex. *Lower glume* 1.4–1.9 mm long, ⅘ as long as the spikelet, 3-nerved, acute. *Upper glume* 1.5–2.1 mm long, 5-nerved, obtuse. *Lower floret* staminate; lower lemma as long as the spikelet, 5-nerved, obtuse or acute, the internerve between the midnerve and the first pairs of lateral nerves widest; lower palea 2-nerved, 2-keeled, shallowly sulcate to nearly flat on the back, 0.1–0.2 mm shorter than the lower lemma; stamens 3, the anthers 1–1.1 mm long, purple; lodicules 2. *Upper floret* 1.5–1.6 mm long, 0.7–0.8 mm wide, bisexual, indurate, sparsely pilose, especially along the margins of the lemma with hairs to 0.3 mm long, otherwise shiny, smooth, with bicellular microhairs all over its surface, apically obtuse; lodicules 2; stamens 3, the anthers ca. 1 mm, purple; styles 2, separate; stigmas plumose, purple. *Caryopsis* unknown.

Panicum tepuianum is only known from the type collection. The epithet is derived from the Arekunan Indian word for the characteristic sandstone table mountains of the Venezuelan Guayana.

The perennial, caespitose habit, 3-nerved lower glume, 5-nerved upper glume and lower lemma, open panicle, and lack of a collar at the juncture of the leaf blade and sheath indicate a relationship of *P. tepuianum* with sections *Lorea* and *Parvifolia* (Renvoize & Zuloaga, 1984; Zuloaga, 1987). Both sections have a large number of species in the Venezuelan Guayana.

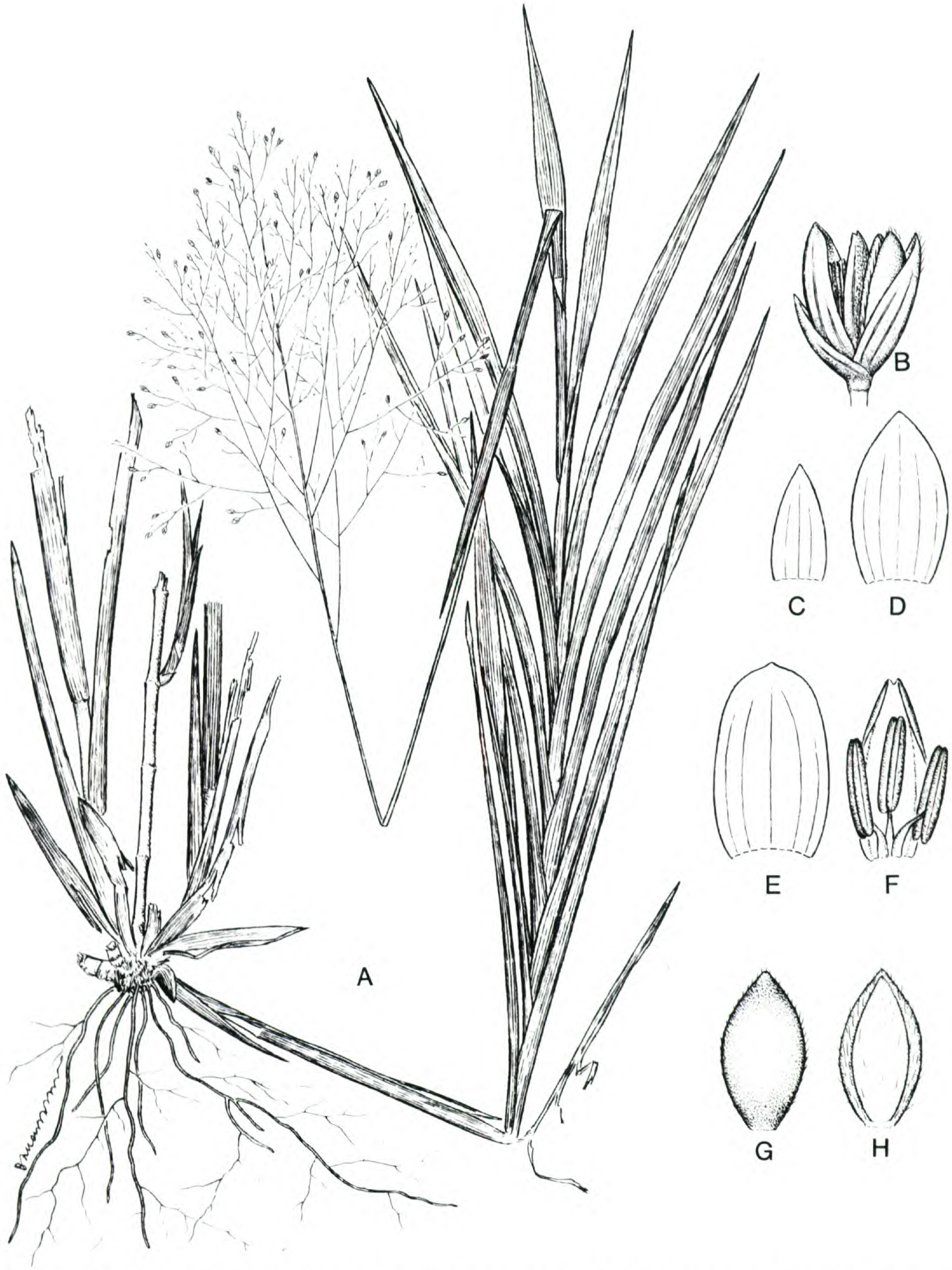
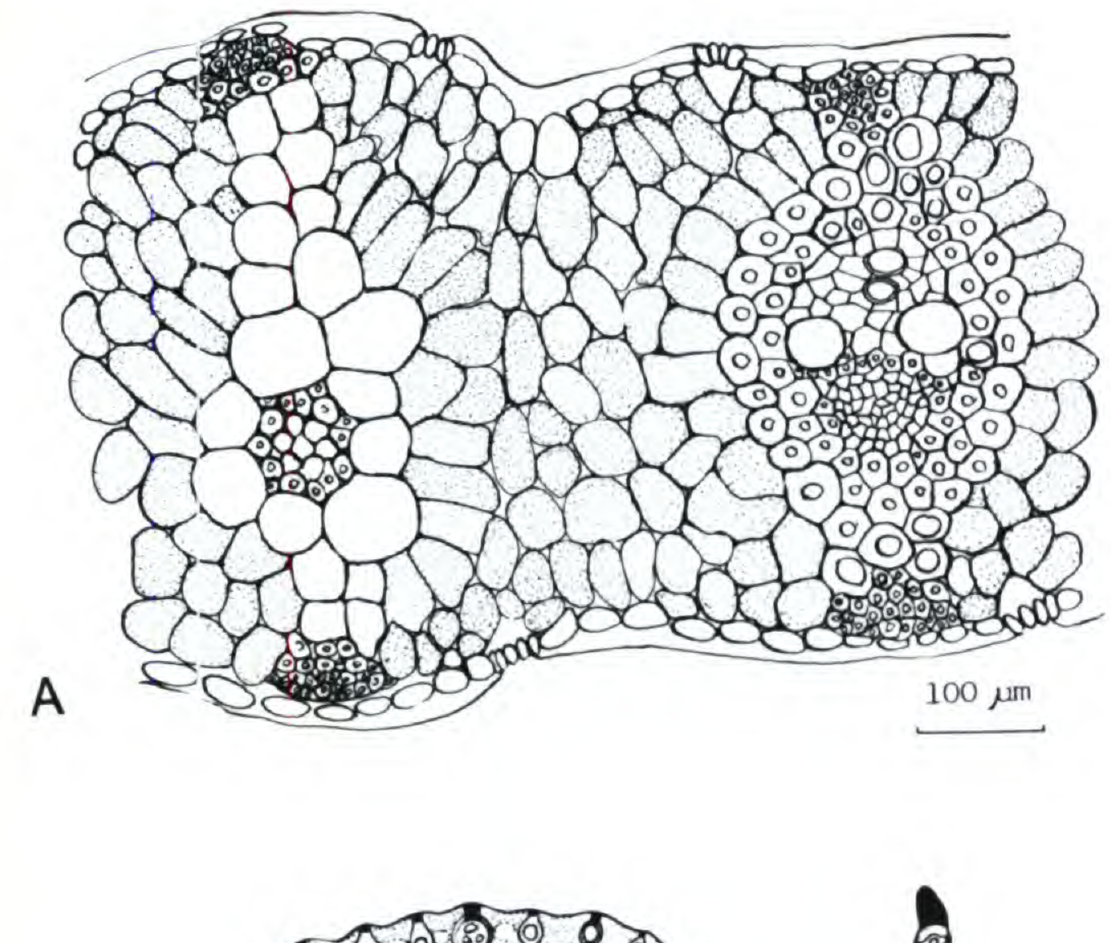
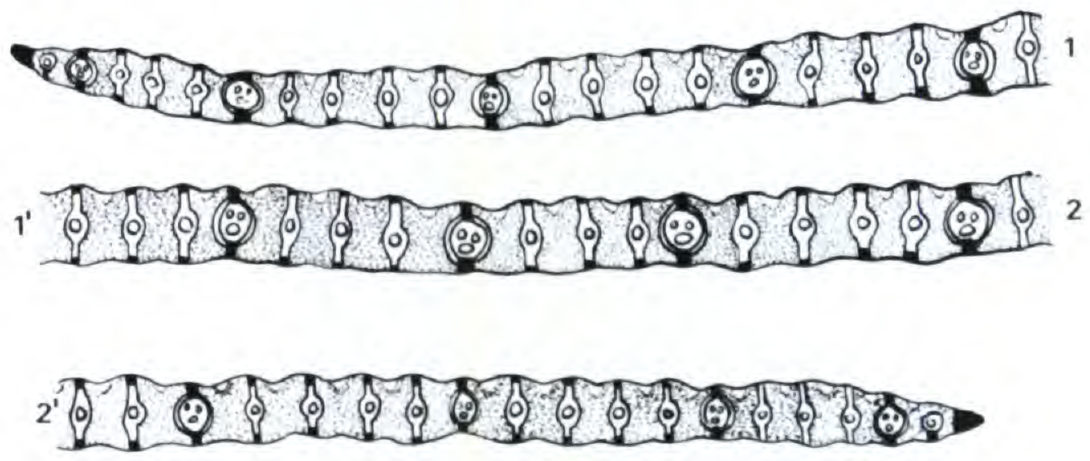
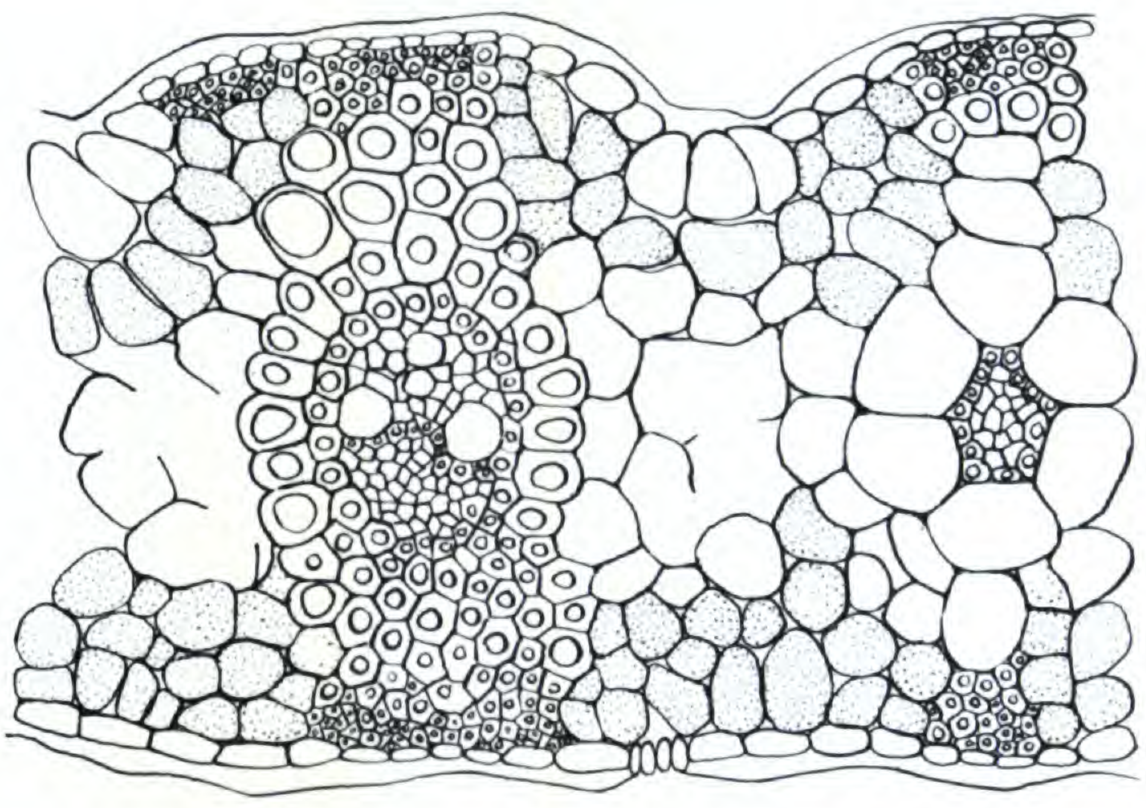
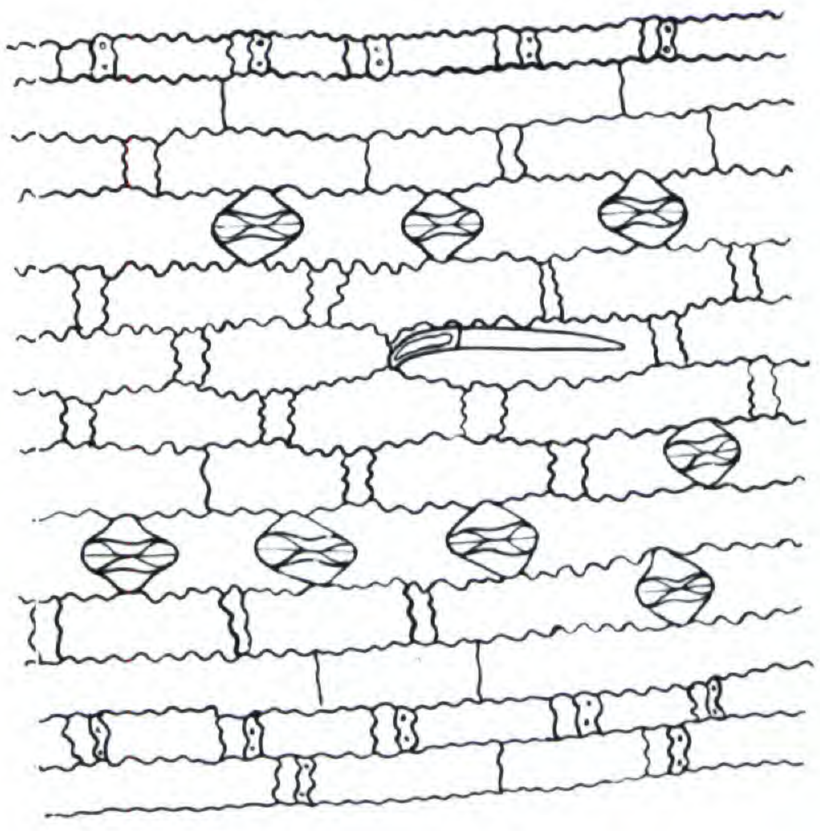


Figure 1. *Panicum tepuianum* (*Liesner & Carnevali 22645*, MO). —A. Habit; note branch developing on injured main culm. —B. Spikelet. —C. Lower glume. —D. Upper glume. —E. Lower lemma. —F. Lower palea and lower staminate flower. —G. Upper floret, lemma view. —H. Upper floret, palea view.









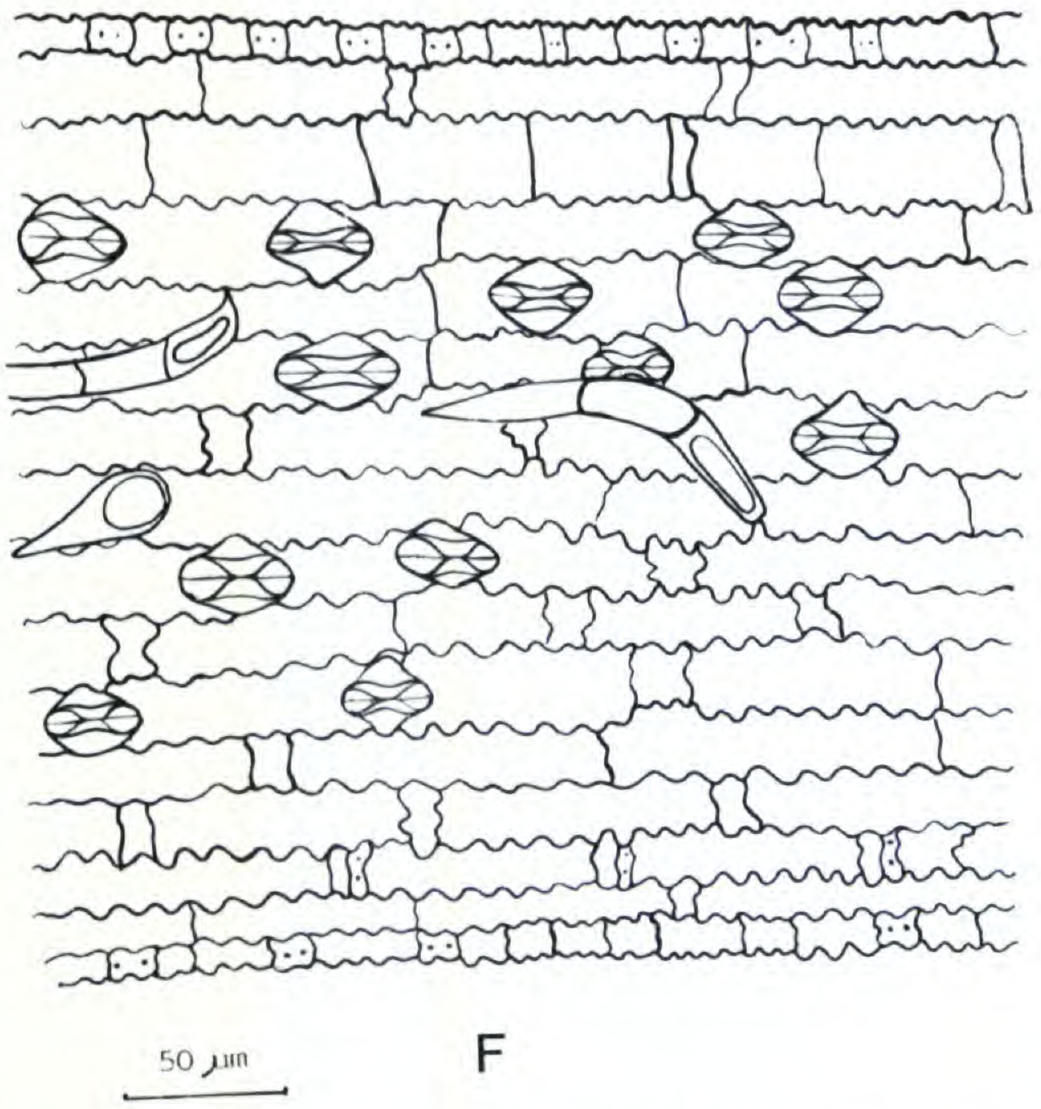


Figure 2. Leaf blade anatomy. A, B, F. *Panicum nervosum.* —A. Transverse section detail showing first- and second-order vascular bundles. —B. Outline of the leaf. —F. Abaxial epidermis showing 3-celled microhairs. C–E. *Panicum tepuianum.* —C. Outline of the leaf showing the keel and air cavities. —D. Transverse section detail showing first- and second-order vascular bundles and air cavities. —E. Abaxial epidermis showing 2-celled microhairs (A, B, F based on *Zuloaga et al. 4424*, SI; C–E based on *Liesner & Carnevali 22645*, MO.)

Panicum tepuianum differs from species of section *Lorea* in its completely membranous ligule, which has no trace of hairs, and the pubescent upper lemma and palea, which also have numerous bottlelike bicellular microhairs.

Within section *Parvifolia*, *P. tepuianum* is related to other caespitose, perennial species, especially *P. cyanescens* Nees ex Trin. and *P. nervosum* Lam. However, in both of these species the upper floret lacks macrohairs. In addition, *P. cyanescens* lacks overlapping sheaths and has spikelets 1.1–2 mm long, whereas *P. nervosum* has blades 8–15 mm wide, with the base amplexicaulous and wider than the sheath, and has subglobose spikelets 1.1–1.7 mm long.

An indumentum of macrohairs on the upper floret is unusual in the genus *Panicum* but occurs in a number of other unrelated species. Especially notable are: *P. chloroleucum* Griseb., *P. racemosum* (P. Beauv.) Sprengel, and *P. urvilleanum* Kunth of section *Urvilleana*; *P. discrepans* Doell of section *Discrepantia*; *P. incumbens* Swallen, *P. cayoense* Swallen, *P. guatemalense* Swallen, *P. trichidiachne* Doell, and *P. arundinariae* Trin. ex Fourn. of section *Parviglumia*, and *P. olyroides* Kunth not assigned to a section by Zuloaga (1987).

Leaf Blade Anatomy

TRANSVERSE SECTION

Outline: U-shaped, the margins involute; leaf 280–390 μm thick on ribs adjacent to the midnerve and 180–230 μm thick toward the margins; adaxial ribs and furrows ± conspicuous, the ribs truncate to rounded, the furrows ⅕ or less the width of the blade; abaxial ribs and furrows slightly pronounced. *Keel* prominent, with a first-order vascular bundle structurally distinguishable from lateral first-order vascular bundles and associated with second-order vascular bundles; colorless parenchymatous cells and conspicuous air cavities present; adaxial surface flat; abaxial surface convex. *Vascular bundle arrangement:* 12 first-order vascular bundles and 36 second-order vascular bundles present, 3–4 second-order vascular bundles between contiguous first-order vascular bundles, (4–)5–8 mesophyll cells between adjacent vascular bundles, with a distance of 170–350 μm between contiguous vascular bundles. *First-order* vascular bundles situated in the center of the blade, circular in outline; outer parenchymatous sheath with globose, translucid cells, without specialized chloroplasts and smaller than the adjacent mesophyll cells, with their radial and inner tangential walls strongly thickened; outer sheath interrupted by sclerenchyma girders toward both epidermises; metaxylem vessels slightly angular in outline; phloem adjacent to the mestome sheath; inner mestome sheath complete. *Second-order* vascular bundles angular in outline; outer sheath complete, with 6(–7) globose, translucid cells, larger than the adjacent mesophyll cells, without specialized chloroplasts; sclerenchyma girders present; extensions of the outer sheath present toward both surfaces, uni- or biseriate, occasionally with transitional cells in contact with the sclerenchyma; xylem and phloem distinct; inner mestome sheath complete. *Chlorenchyma* nonradiate; chlorenchyma cells isodiametric or less frequently tabular, with smooth walls, with a higher density of chloroplasts toward the abaxial surface; air spaces numerous. Air cavities present between vascular bundles, without aerenchyma cells. Groups of 3–4 fan-shaped *bulliform cells* regularly distributed on the adaxial furrows.

ABAXIAL EPIDERMIS

Costal zones with irregular silica bodies, alternating with rectangular cork cells, transversely elongated and with crenate walls; costal long cells similar to the ones of the intercostal zones; prickles not observed. *Intercostal zones* 7–15 cells wide, long cells rectangular in shape, with sinuous, thick walls, alternating with solitary short cells, less frequently paired; short cells rectangular in shape, transversely elongated, with crenate walls; silica bodies irregular in outline. *Stomatal complex* triangular, 31–39 μm long, in 1 to 3 rows on both sides of the costal zones. *Microhairs* 2-celled, isolated in the intercostal zones, the walls of the basal cell thicker than the walls of the distal cell; distal cell more than two times as long as the basal cell, rounded at the apex. Hooks and macrohairs not observed. Papillae absent.

Panicum tepuianum is related to other species of section *Parvifolia* with conspicuous extensions of the outer parenchymatous sheath, especially *P. nervosum*. *Panicum nervosum* shares the following anatomical characters with *P. tepuianum:* C_3 anatomy, with a similar leaf thickness in transverse section, the outer parenchymatous sheath of the first-order vascular bundles with manifest thick cells, extensions of the outer parenchymatous sheath toward both epidermises, the mesophyll not radiate but lax, with tabular or isodiametric cells, with smooth walls. *Panicum nervosum* differs from *P. tepuianum* by the absence of air cavities in transverse section, extensions of the outer parenchymatous sheath with a higher number of cells, and by the presence of three-celled microhairs on the abaxial epidermis.

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Fissidens (sect. *Aloma*) *cylindrothecus* (Bryopsida: Fissidentaceae), a New Species from Colombia

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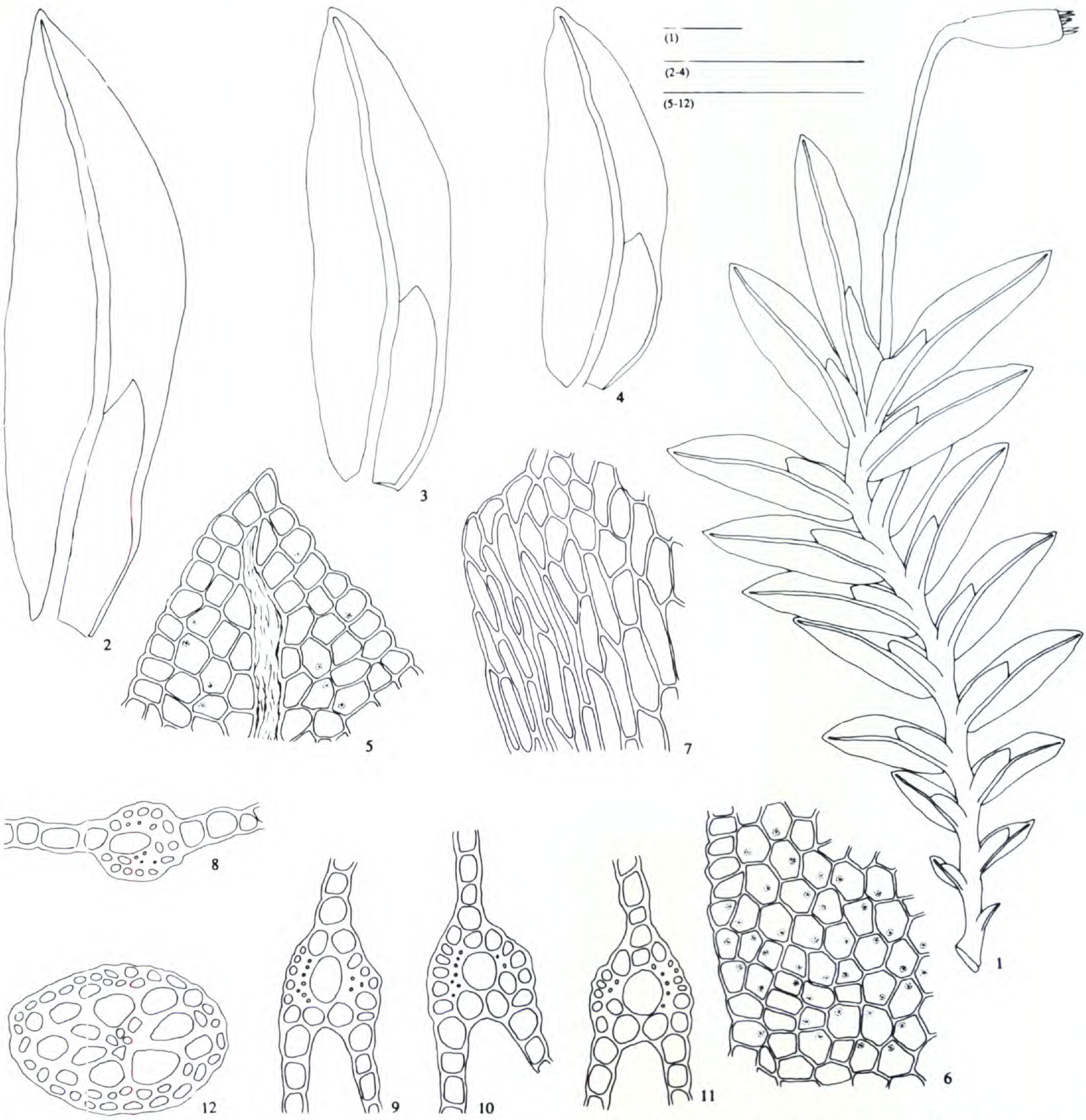
During the course of a review of section *Aloma* C. Müll. for a monograph of the neotropical species of *Fissidens*, a specimen from southwestern Colombia thought initially to represent a variant of *F. laxus* Sullivant & Lesq. (including *F. pellucidus* Hornsch. and *F. flexinervis* Mitten) was found on closer examination to have a number of unusual characteristics. Thus we propose the following new species to accommodate this collection.

Fissidens cylindrothecus Pursell & Aguirre, sp. nov. TYPE: Colombia. Cauca: Munic. de Guapi, Parque Natural Nacional Isla Gorgona, Camino Poblado–Playa Pizarro, 50 m, 3 June 1986, *Santana, Lozano & Rangel 737* (holotype, COL; isotype, PAC). Figures 1–13.

Species haec ab aliis speciebus in sectione cellulis ductibus insolenter magnis (1–2 distalibus et 3–4 proximalibus), thecis cylindricis, dentibusque peristomatis singulariter spiraliter incrassatis, fere usque ad basin divisis, inflexis siccis et erectis humidis differt.

Plants small, in scattered patches, pale to olive-green, often tinged with brown. Stems unbranched or branched near distal ends, erect to decumbent, to ca. 6 mm long and 2 mm wide, with as many as 11 pairs of leaves; axillary hyaline nodules lacking; in cross section with 1–2 tiers of small, thick-walled outer cells, larger, thinner-walled inner cells, and central strand; rhizoids smooth, basal and axillary. Leaves usually imbricate distally, little shrunken when dry, somewhat brittle, lanceolate, to ca. 2 mm long and 0.3–0.5 mm wide where broadest, acute to cuspidate; margins crenulate-serrulate but nearly entire in proximal parts of vaginant laminae; costae ending 2–3 cells below the leaf apices, (27–)31–40(–49) μm broad at distal ends of vaginant laminae, terete in cross section, with 2 stereid bands, (1–)2 guide cells in distal parts, and 3(–4) guide cells in proximal parts, one guide cell often larger than others; dorsal laminae usually rounded at insertion, not decurrent; vaginant laminae ca. ⅖(–½) the leaf length, unequal, the minor laminae usually attached ca. ½ the distance between the costae and leaf margins, infrequently rounded and attached only along costae, sometimes narrowed to costae in perichaetial leaves, homostichous; laminal cells unistratose, guttulate, firm-walled, smooth, bulging, somewhat elongate-hexagonal to irregularly quadrate, 14–29 μm long, marginal cells somewhat smaller, 11–15 μm long, often somewhat wider; inner cells of vaginant laminae similar to upper cells, marginal vaginant laminal cells often narrow and elongate, forming weak and often inconspicuous limbidia. Autoicous; perigonial branches small and bud-like or somewhat elongate and emergent to extending well above the enveloping vaginant laminae; perichaetia terminal on main stems and branches. Sporophytes one per perichaetium; setae yellow, darkening with age, (0.9–)1.4–1.9 mm long; thecae inclined to pendant, ± symmetric, cylindric, 0.5–0.7 mm long, stomatose, exothecial cells mostly oblong, trigonous; annuli lacking; peristomes inflexed when dry, erect when moist, each consisting of 16 teeth, each tooth divided nearly its entire length into 2 slightly unequal prongs, with ± horizontal thickenings proximally and spiral thickenings distally, ventral trabeculae distinctly wider than lamellar thickenings but lacking fimbriate ornamentation; opercula long-rostrate. Spores smooth, 11–13(–18) μm. Calyptrae smooth, cucullate, covering only the rostra.

Fissidens cylindrothecus is a remarkable species in both its peristome and costal structure. It is the only neotropical species in section *Aloma* with a peristome that is erect when moist; all other species in the section have peristomes that are erect when dry but strongly inflexed when wet. The peristome of *F. cylindrothecus* is morphologically close to the scariosus type described by Allen (1980), and Bruggeman-Nannenga & Berendsen (1990), which is typical of section *Aloma*. This type of peristome is divided about ⅔ its length and has horizontal ridges



Figures 1–12. *Fissidens cylindrothecus*, Pursell & Aguirre. —1. Habit. —2–4. Leaves. —5. Leaf apex, with guttulae. —6. Median cells of dorsal laminae, with guttulae. —7. Mid-marginal region of vaginant lamina of perichaetial leaf. —8. Cross section of distal region of leaf. —9–11. Cross sections of proximal regions of leaves. —12. Cross section of stem. All drawn from holotype. Bar scale (1) = 0.5 mm; bar scale (2–4) = 0.5 mm; bar scale (5–12) = 100 μm.

(thickenings) on the proximal dorsal lamellae. The horizontal lamellae are succeeded above the bifurcation by vertical ridges, which are replaced by spiral thickenings in the distal portions of the prongs. In addition, the ventral lamellae of the scariosus type are usually equipped with conspicuous fimbriate ornamentations. Peristome teeth of *F. cylindrothecus*, on the other hand, are divided nearly their entire length, the more or less horizontal thickenings of the proximal dorsal lamellae are succeeded immediately by spiral thickenings (Fig. 13), and the ventral trabeculae lack the fimbriate ornamentation.

Guide cells in the costae of *F. cylindrothecus* are often sufficiently large to be noticeable in surface view. This feature was noted by Robinson (1974) in *F. ornaticostatus* Robinson and has been observed also in some collections of *F. laxus* made recently in French Guiana by W. R. Buck. The costae of species of section *Aloma*, as well as those in most other sections of *Fissidens*, have two stereid bands separated by a row of 2 guide cells distally and 3 guide cells proximally, which are arranged more or less in the form of a triangle. Although this is basically the costal structure seen in *F. cylindrothe-*

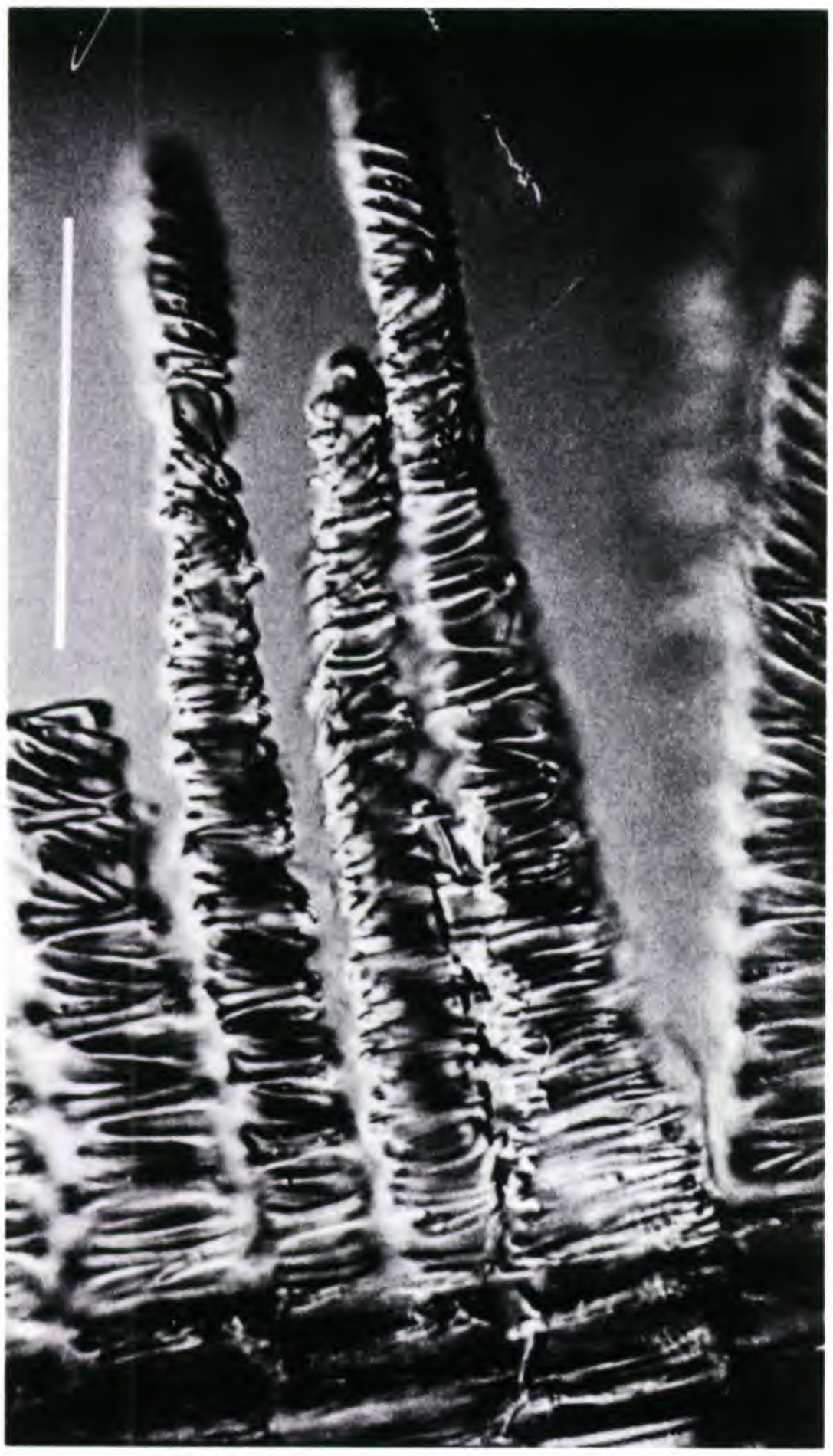


Figure 13. Teeth from peristome of *Fissidens cylindrothecus*. sp. nov. Photographed from isotype. Bar scale = 45 μm.

cus, the costa in this species can have one or two guide cells in its distal length and 3–4 guide cells in its proximal portion (Figs. 8–11). Costae of the French Guianian specimens of *F. laxus*, however, have the typical structure. Since *F. ornaticostatus* is represented by only two stems, sections have not been made to determine the number of guide cells present. Robinson's illustrations, however, show two rows of guide cells in the distal part of the leaf and a single row of very large guide cells proximally; this reflects what can be seen in surface examination of the holotype (*Skottsberg 26 pro parte*, S).

Fissidens cylindrothecus may be confused with *F. diplodus* Mitten and *F. cylindraceus* Mitten because all three species have long cylindrical capsules. Moreover, all three have peristomes that stand erect when moist. Both *F. diplodus* and *F. cylindraceus*, however, belong to section *Semilimbidium* C. Müll. They are characterized by distinct unistratose limbidia on the vaginant laminae of perichaetial leaves, and either by bluntly unipapillose laminal cells (*F. diplodus*) or pluripapillose laminal cells (*F. cylindraceus*). In addition, the peristome teeth of *F. diplodus* are more or less undivided, and vertically striate and papillose; the peristome teeth of *F. cylindraceus* are each divided almost the entire length into two slender prongs that have vertically oriented thickenings proximally and spiral thickenings distally.

Fissidens cylindrothecus is most closely related to *F. laxus*, a widely distributed and variable species in the Neotropics and also the Paleotropics of Asia. The two species are best distinguished by their peristomes (see above) and capsule shape, cylindric and ovate, respectively. Otherwise, both species have relatively large, smooth, firm-walled laminal cells and costae that end below the leaf apices. Guttulae (see Pursell, 1989) are characteristic of many species in section *Aloma* and are a prominent feature of most specimens of *F. laxus*. These structures are not as conspicuous in *F. cylindrothecus*, but this could be a feature of this initial gathering of the species only. As stated earlier, large guide cells are present in a number of specimens from French Guiana that have been assigned to *F. laxus*. These specimens, however, are sterile. Sporophytes could show that these populations belong to *F. cylindrothecus* or perhaps to an undescribed species.

Acknowledgments. The authors thank S for a loan of the holotype of *F. ornaticostatus* and William R. Buck, The New York Botanical Garden, for sending his recent collections of *Fissidens* from French Guiana to the senior author for study. Carol Kuss, The Pennsylvania State University, photographed the peristome seen in Figure 13. We also thank Bruce Allen, Missouri Botanical Garden, for providing the Latin diagnosis, for reading an early version of the manuscript, and for his invaluable suggestions. The research was supported by a National Science Foundation grant, BSR-8905431, to the senior author.

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Sclerolobium Vogel (Caesalpiniaceae), un Nuevo Género para América Central

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El género *Sclerolobium* está constituido por alrededor de 39 especies (Dwyer, 1957; Pires, 1960; Cowan, 1961; Williams, 1964; Irwin & Arroyo, 1974; Polhill & Raven, 1981), las cuales son estrictamente suramericanas. Entre un 75% a 80% tienen su centro de distribución en la Amazonia brasileña. La presente especie pertenece a la sección *Cosymbe* (Tul.) Baillon por la forma y tamaño de los pétalos.

Sclerolobium costaricense Zamora & Poveda, sp. nov. TIPO: Costa Rica. Alajuela: San Carlos, El Concho de Pocosol, 70 m, 10°8′N, 84°27′W, 7 June 1989 (fl), *Zamora & Poveda 1555* (holotipo, CR; isotipos, COL, F, MO, NY, PMA, US). Figura 1.

Arbor 40-metralis. Ramuli angulati, minute ferrugineo-sericei; stipulis persistentibus, usque 1.8 cm longis, pectinatis, segmentis 5–6, cucullatis, minute ferrugineo-sericeis; petiolis canaliculatis, 4–10 cm longis; rhachidibus 6.5–25 cm longis, canaliculatis, petiolulis 3–7 mm longis; foliolis (2–)3–6-jugatis, oblongis, 6.5–23 cm longis, (3–)4–8.3 cm latis, apice ex acutis abrupte acutis rotundatisve, basi ex inaequilateribus rotundatis, interdum breviter cordatis, supra subglabris, subtus fulvo-sericeo-pubescentibus vel glabrescentibus, costa supra impressis infra prominente, venis secundariis 10–18, supra graciliter impressa infra prominulis, proximaliter strictis distaliter arcuatis. Paniculae dense racemosae, 10–28 cm longae, rhachidibus angulatis, dense minute ferrugineo-sericeis, racemis 2.2–13 cm longis; floribus subsessilibus; sepalis 4–4.5 mm longis, 3 mm latis, utrinque dense sericeis ciliatisque; petalis claviformibus, 3–4 mm longis, 1.5–2 mm latis, extus basi pauce pilosis, intus pilosis; filamentis 6–6.5 mm longis, basi ferrugineo-pilosis; antheris 2 mm longis, oblongis; stipite ovarii ad 2 mm longo, ovario ad 3 mm longo, hispido-ferrugineo, 8-ovulato. Fructus usque 14.2 cm longus, 3.1 cm latus.

Arbol hasta de 40 m de altura; tronco derecho, cilíndrico, con gambas de tamaño mediano; copa amplia; corteza externa pardo-grisácea, lisa y lenticelada; ramitas ánguladas y diminutamente seríceo-ferrugíneas; estípulas hasta de 1.8 cm de largo, persistentes al final de las ramitas y en la inflorescencia, seríceo-ferrugíneas, pectinadas, pedículo de 3–4 mm de largo, segmentos 5–6, cuculados, el distal hasta de 7 mm de largo y 4 mm de ancho. Hojas paripinnadas, raras veces imparipinnadas, pecíolo acanalado, de 4–10 cm de largo, raquis de 6.5–25 cm de largo, acanalado y con un diminuto repliegue entre los pares de folíolos, folíolos opuestos, (2–)3–6 pares, oblongos, 6.5–23 cm de largo, (3–)4–8.3 cm de ancho, ápice de agudo a abruptamente agudo o redondeado, base de asimétrica a redondeada, algunas veces muy levemente cordata, nervio central y nervios secundarios levemente impresos en la haz y prominentes en el envés, venas secundarias 10–18 por lado, saliendo en un ángulo de ± 40 grados y anastomosándose cerca del borde, la superficie diminutamente pardo-serícea sólo en el nervio central y nervios secundarios por el haz, densamente y diminutamente pardo-seríceo-fulvescentes o llegando a ser glabrescentes en el envés, peciólulos 3–7 mm de largo, seríceos y acanalados. Flores dispuestas en panículas densamente racemosas, piramidales, pedunculadas, axilares y terminales, 10–28 cm de largo, ejes ángulados, densamente y diminutamente ferrugíneo-seríceos, brácteas decíduas, racimos 2.2–13 cm de largo, muy raras veces inflorescencias racemosas solitarias y axilares. Flores con pedicelos de 1 mm de largo, sostenidas por una bractéola normalmente decídua, hasta de 2 mm de largo, triangular, los bordes levemente revolutos, pubescencia pardo-serícea, densa en ambas superficies; sépalos 5, imbricados, 4–4.5 mm de largo, y hasta de 3 mm de ancho, los más externos más pequeños, ovados, cóncavos, densamente pardo-seríceos en ambas superficies, ciliados; pétalos 5, amarillos, con venación conspicua en la superficie externa, claviformes, 3–4 mm de largo, 1.5–2 mm de ancho, alternos a los sépalos, con

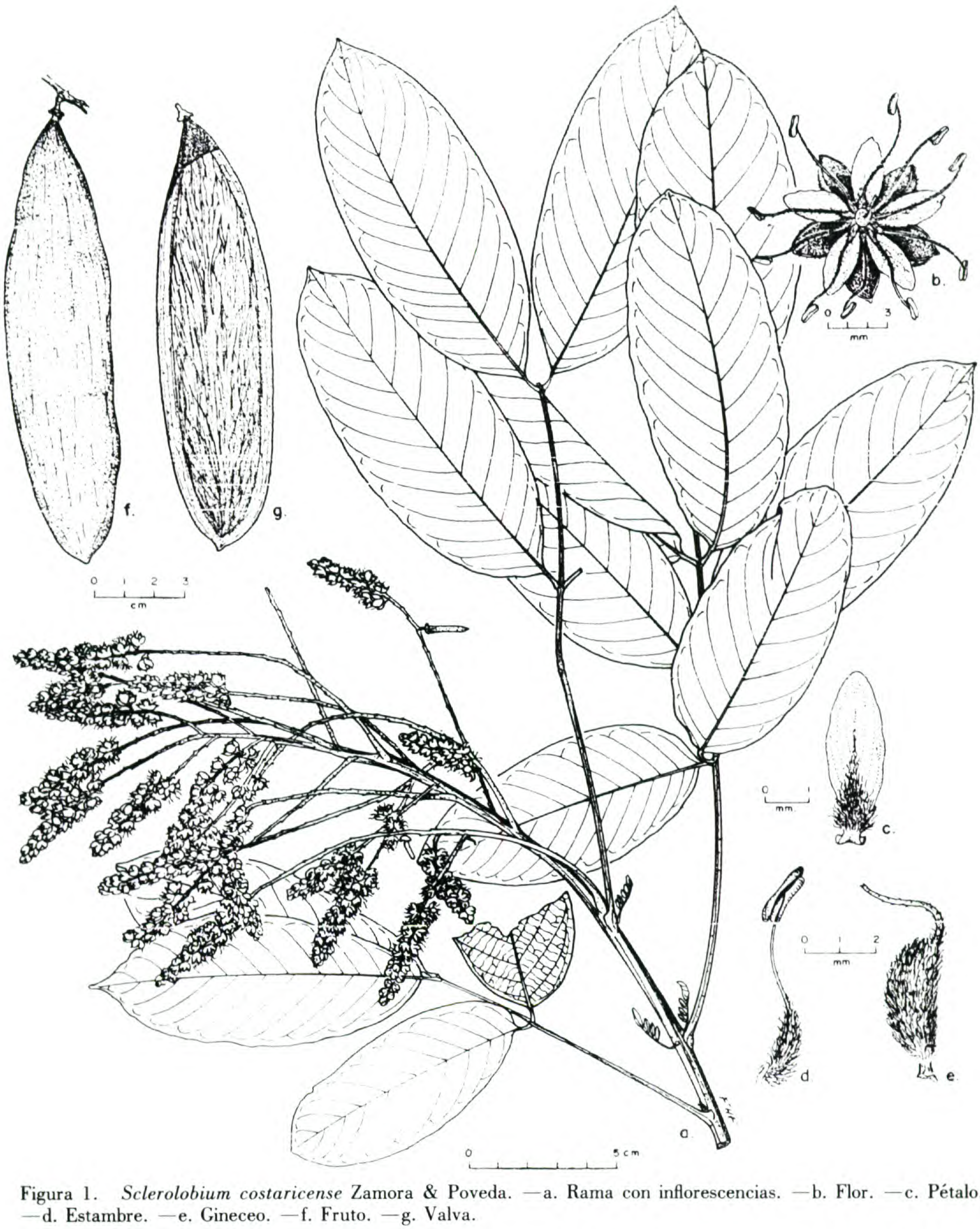

Figura 1. *Sclerolobium costaricense* Zamora & Poveda. —a. Rama con inflorescencias. —b. Flor. —c. Pétalo. —d. Estambre. —e. Gineceo. —f. Fruto. —g. Valva.

pocos pelos sólo en la base sobre la superficie externa, pilosos en la superficie interna; estambres 10, libres, filamentos 6–6.5 mm de largo, densamente pilosos sólo en la mitad basal, anteras versátiles, oblongas, tecas 2, de 2 mm de largo, dehiscentes longitudinalmente; pistilo ± sigmoide; ovario estipitado algo falcado, 3 mm de largo, densamente híspido-ferrugíneo y sulcado, estípite de 2 mm de largo; estilo glabro, hasta 3 mm de largo, óvulos 8, superpuestos. Frutos aplanados, 12–14.2 cm de largo, hasta 3.1 cm de ancho, ápice obtuso o apiculado, glabros, pardo-negruzcos con los márgenes ondulantes y dehiscentes lateralmente.

Colecciones adicionales examinadas. COSTA RICA. HEREDIA: Finca La Selva, the OTS Field Station on the

Río Puerto Viejo just E of its junction with Río Sarapiquí, 100 m, 9 Oct. 1980, (fr), *Hammel 10106* (DUKE), 5 June 1981 (fl), *Hammel & Trainer 10815* (DUKE, US), 7 July 1979 (brinzal), *Beach & Foster 1463* (F); Parque Nacional Braulio Carrillo 15 km SO de Horquetas, O de Rara Avis entre Río Guácimo y Río Peje, 600 m, 10°20′N, 84°02′O, 26 abr. 1989 (fl inm.), *Hammel et al. 17324* (CR). GUANACASTE: Parque Nacional Guanacaste Estación Pitilla, 5 km N de la Estación al lado del camino en remanente de Bosque primario, La Pasmompa, 450 m, 11°59′N, 85°25′O, 15 July 1989 (fl), *Hammel et al. 17475* (CR, MO). LIMÓN: Reserva Cord. Volcánica Central, in forest on slopes along small stream ca. 2 km E of lower Park station, Braulio Carrillo, Finca Gonzáles San José–Guápiles highway, 500 m, 10°13′N, 85°55′O, 16 abr. 1988 (fl), *Hammel et al. 16677* (CR, MO); Parque Nacional Braulio Carrillo, Estación Carrillo, *Poveda et al. 4175* (CR). SAN JOSÉ: Parque Nacional Braulio Carrillo, Estación Carrillo, 700 m, 4 dic. 1984 (fl), *Chacon 1753* (CR).

Distribución y hábitat. Hasta el momento la especie es endémica para Costa Rica, conocida en la parte noreste de la vertiente atlántica, desde la Estación Carrillo, Parque Nacional Braulio Carrillo, Provincia San José, 700 m de elevación, hasta El Concho de Pocosol, San Carlos, Provincia Alajuela, 70 m de elevación. Crece en bosque tropical muy húmedo transición a premontano y bosque tropical muy húmedo (Tosi, 1969). Se encuentra en laderas con pendientes medias y terreno plano con buen drenaje. En la localidad de El Concho de Pocosol es un árbol común, conspicuo por su tamaño y copa muy amplia, con un follaje pardo-verdoso característico.

Nombre vernáculo. Se conoce con el nombre "Tostado."

El género más afín, *Tachigali* Aubl., comparte más o menos la misma relación porcentual de especies con centro de distribución en la misma región. También está representado en Costa Rica por una sola especie (*T. versicolor* Standley & L. O. Williams). Con el descubrimiento de esta nueva especie de *Sclerolobium*, Costa Rica representa el área geográfica más septentrional y aislada del centro de distribución para ambos géneros. En Costa Rica, *S. costaricense* y *T. versicolor*, se distribuyen en áreas geográficas opuestas, ya que *T. versicolor* se encuentra en la parte suroeste de la vertiente pacífica.

Fenología. Se ha observado con flores de diciembre, abril, mayo, junio, y julio; en la localidad El Concho de Pocosol se ha observado su máxima floración durante finales de mayo e inicios de junio. Frutos observados en octubre.

Usos. La madera es semidura y se usa para construcción en general.

Agradecimientos. Nuestro sincero agradecimiento a Enrique Forero por la revisión del manuscrito, a Henk van der Werff por su colaboración en la descripción en latín, y a Francisco Hodgson F. por la ilustración. El trabajo en los herbarios de los Estados Unidos, para el primer autor, fue posible gracias al goce de una beca otorgada por el Missouri Botanical Garden con fondos de Jessie Smith Noyes Foundation.

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Stylogyne rodriguesiana (Myrsinaceae): a New Androdioecious Species from Amazonia

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Floristic inventories conducted by the staff at the Instituto Nacional Pesquisas da Amazônia (INPA) in and around Manaus during the 1960s and 1970s, and in September 1990 at the Morro do Seis Lagos, have yielded a hitherto undescribed species with erect calyces, highly twisted, contorted corolla lobes, and uniseriate ovules in the bisexual flowers, which unmistakably require its placement in the genus *Stylogyne* A. DC.

Stylogyne rodriguesiana Pipoly, sp. nov. TYPE: Brazil. Amazonas: Manaus, Igarapé do Cachoeira, Alta de Taruma, 4 Aug. 1961 (bisex. fl), *Rodrigues & Chagas 3092* (holotype, INPA; isotype, NY). Figure 1.

Ob inflorescentias axillares et bi- vel tripinnatim paniculatas, perianthia coriacea et antheras angustissimas, *S. atrae* Mez valde affinis, sed ab ea ramulis floriferis racemosis (non corymbosis), calycis lobis medium versus rugosis lepidotisque (non laevibus glabrisque) et secus marginem undulatis (nec crenatis), corollae lobis asymmetricis (nec symmetricis), antheris lineari-lanceolatis (nec ovatis), apiculatis (nec rotundatis) praeclare distat.

Shrub or tree to 4 m tall. Branchlets, leaves, inflorescence rachis, and pedicels glabrous. Leaves elliptic to obovate-elliptic, chartaceous to coriaceous, (14–)19–24(–29) cm long, (4.7–)6–10 cm wide, apex acute or acuminate, base acute, decurrent on the petiole, costa raised below, impressed above, the secondary nerves brochidodromous, prominently black punctate and lineate, the margin entire, subrevolute; petioles 1.0–1.5 cm long, deeply canaliculate. Inflorescence axillary or pseudoterminal, bi- or tripinnately paniculate, 4–15 cm long; peduncle (1.2–)1.9–2.3–3(–4) cm long; pedicels cylindrical, 2.2–5.2 mm long, accrescent in fruit. Staminate and bisexual flowers: calyx coriaceous, cotyliform, 2–2.7 mm long, the tube 0.1–0.3 mm long, the lobes ovate, 1.8–2.2 mm long, 1–1.3 mm wide, apex acute, rugose and translucent lepidote medially, the margin hyaline, irregularly undulate, with a few subapical teeth; corolla campanulate, coriaceous, 4.9–5.2 mm long, the tube 0.5–1.0 mm long, the lobes elliptic to oblong, asymmetric, 4.4–5.2 mm long, 1.5–1.6 mm wide, apex acute, prominently black punctate-lineate, the margin opaque, entire; stamens 4.2–5 mm long, inserted ca. 0.1 mm above the base of the corolla, the filaments free, 2–2.5 mm long, the anthers linear-lanceolate, 2.5–3.1 mm long, apex apiculate, base sagittate, dehiscent by confluent apical pores at first, then by latrorse longitudinal slits; pistil and pistillode obturbinate, 1.7–2.2 mm long, 3–5-angled in cross section, densely lepidote; pistil with the ovules 3–7, uniseriate, buried in the basal placenta. Fruit globose, 0.8–1.4 cm diam. when dried.

Paratypes. BRAZIL. AMAZONAS: Estrada Manaus–Itacoatiara, km 8, Colonia Santo Antonio, 2 June 1955 (stam. fl), *Chagas s.n.* (INPA), 8 Sep. 1966 (fr), *Prance et al. 2222* (INPA, NY); km 26, Reserva Forestal Ducke (regeneração), 30 July 1976 (ster.), *Alusio s.n.* (INPA), 12 Aug. 1976 (ster.), *Alusio s.n.* (INPA), 2 Sep. 1976 *Alusio s.n.* (INPA), 3 Sep. 1976 (ster.), *Alusio s.n.* (INPA), 20 Oct. 1976 (ster.), *Alusio s.n.* (INPA); Estrada Manaus–Itacoatiara km 28, 22 Nov. 1960 (bisex. fl, fr), *Rodrigues & Chagas 1926* (INPA); Estrada Manaus–Itacoatiara, km 69–70, Sep. 1973 (fr), *Prance et al. 17531* (INPA, NY); km 70, 12 Oct. 1961 (fr), *Rodrigues & Lima 3426* (INPA); Estrada Manaus–Caracari, km 45, Estação Experimental de Silvicultura Tropical, 23 Sep. 1977 (bisex. fl), *Ribamar & Ramos 397* (INPA); Munic. Manaus, Estrada do Aleixo, 12 Aug.–1 Sep. 1936 (fr), *Krukoff 7965* (F, MO, NY); Rio Preto, 30 Jan. 1962 (bisex. fl), *Rodrigues & Lima 4160* (INPA); Igarapé do Parque 10, 22 Feb. 1956 (bisex. fl), *Chagas s.n.* (INPA); Igarapé do Passarinho, 17 June 1955 (stam. fl), *Coêlho s.n.* (INPA); Igarapé do Bind, 23 July 1956 (bisex. fl), *Dionisio s.n.* (INPA), 9 Aug. 1956 (stam. fl), *Coêhlo s.n.* (INPA); Cachoiera alta do Taruma, 28 July 1961 (bisex. fl), *Rodrigues & Chagas 3056* (INPA), 10 Oct. 1961 (fr), *Rodrigues & Chagas 3393* (INPA); Igarapé do Buiço, 23 Oct. 1961 (fr), *Rodrigues & Chagas 3503* (INPA), 23 July 1962 (bisex. fl), *Rodrigues & Chagas 4551A* (INPA), 2 Aug. 1962 (stam. fl), *Rodrigues & Chagas 4573* (INPA); Manaus, AM-1, km 185, 18 Nov. 1965 (fr), *Rodrigues & Coêhlo 7268* (INPA); Morro dos Seis Lagos, 66°45′W, 0°20′N, 30 Sep.–12 Oct. 1990 (ster.), *B. Nelson 2077, 2150* (both INPA, MO), (bisex. fl), *B. Nelson 2142, 2354, 2603* (all INPA, MO).

Stylogyne rodriguesiana is endemic to the area proposed as the Manaus Refugium (Prance, 1982). It is most closely related to *S. atra* Mez, but is distinguished from that species by racemose branchlets of the panicles, undulate calyx lobes, which are rugose and lepidote medially, asymmetric corolla lobes, and apiculate linear-lanceolate anthers. It ap-

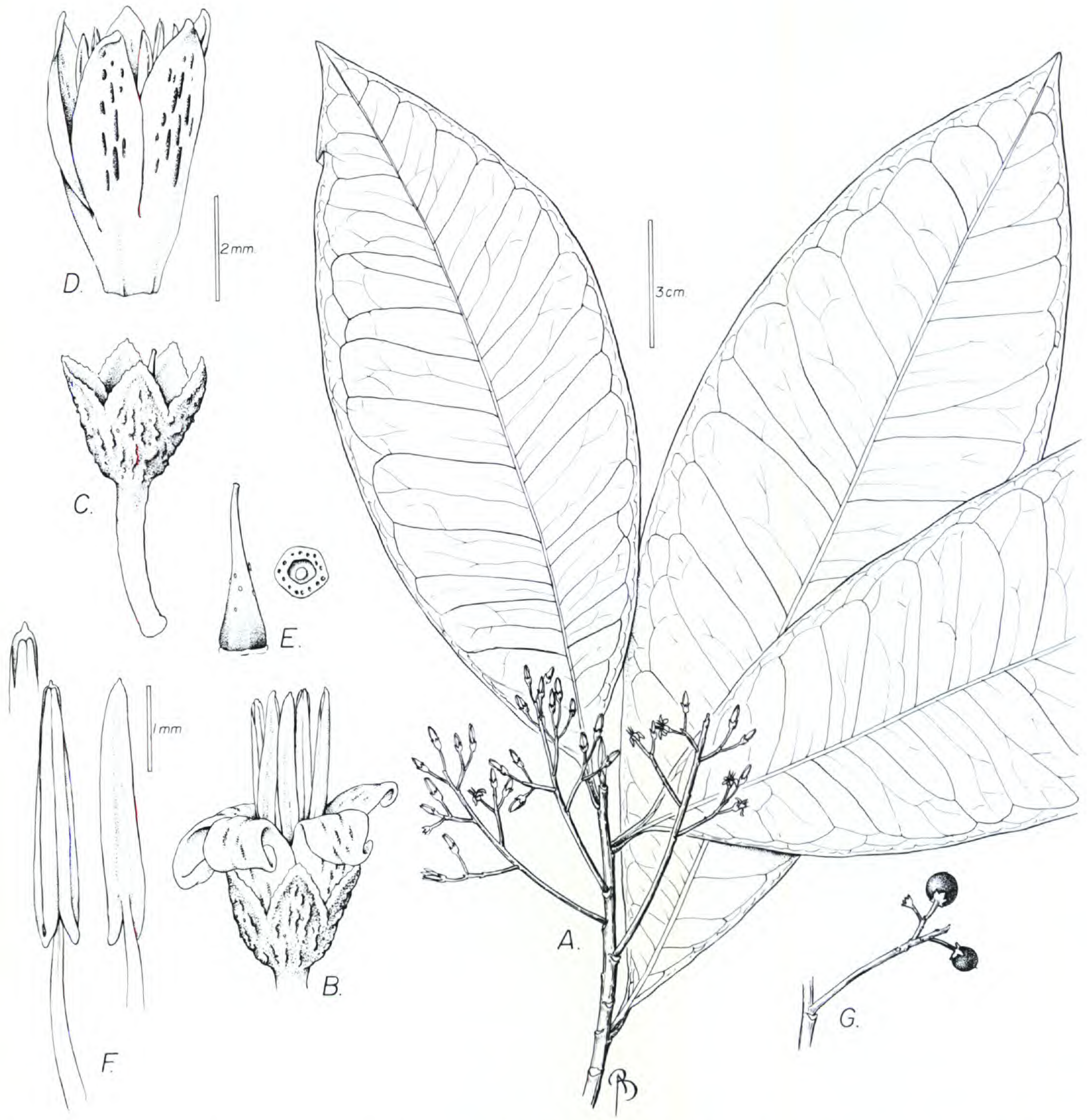

Figure 1. *Stylogyne rodriguesiana* Pipoly. —A. Habit, showing axillary panicles. —B. Bisexual flower at early anthesis, showing reflexed petals and anther habit. —C. Calyx, showing rugose lobes with hyaline margins and minute lepidote scales medially. —D. Corolla, showing asymmetric lobes with prominent punctate lineations. —E. Pistil, showing translucent lepidote scales and ovule immersed in placenta in cross section. —F. Anthers, showing two confluent apical pores and longitudinal sutures. —G. Infructescence, habit. (A–F, drawn from holotype. G, drawn from *Prance et al. 2222.*)

pears that *S. atra* is restricted to várzea habitats, while *S. rodriguesiana* is restricted to campinas. It is with great pleasure that I dedicate this species to William Rodrigues, friend, colleague, and preeminent authority on the systematics of the Myristicaceae.

Acknowledgments. My work in documentation of neotropical plant species diversity is supported by the John D. and Catherine T. MacArthur Foundation, which I gratefully acknowledge. I thank Bobbi Angel for her skillful illustration. Background studies were the result of a Herbarium Graduate Fellowship at the New York Botanical Garden.

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Prance, G. T. 1982. Forest refuges: evidence from woody angiosperms. Pp. 137–156 *in* G. T. Prance (editor), Biological Diversification in the Tropics. Columbia Univ. Press, New York.

Systematic Studies in the Genus *Myrsine* L. (Myrsinaceae) in Guayana

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In preparing the treatment of the Myrsinaceae for the *Flora of the Venezuelan Guayana*, I have encountered the following novelties described herewith.

Myrsine maguireana Pipoly, sp. nov. TYPE: Venezuela. Territorio Federal Amazonas: Cerro de la Neblina, *Bonnetia* forest NW of Caño Grande, 1,200–2,200 m, 8–9 Dec. 1957 (pist. fl, fr), *B. Maguire, J. Wurdack & C. Maguire 42318* (holotype, VEN; isotypes, MO, NY, US). Figure 1.

Ob folia coriacea elliptica vel ovata apice rotundata vel obtusa necnon basi obtusa, inflorescentias glomerulatas, atque praesertim laminas subter scrobiculatas ad *M. glaziovianam* Warming simulans sed ab ea ramulis glabris (non tomentosis), laminis glabris (nec ferrugineo-tomentellis) tum per juvenibus secus marginem glandulari-ciliatis (nec glabris), pedicellis 1–2.5 (nec 0.2–0.5) mm longisque glabris (nec hirsutis), ovario costato (nec tereti) denique corollae lobis glabris (nec dissite longeque pilosis) praeclare distat.

Shrub to 1.5(–2) m tall; branchlets terete, 5–7 mm diam., glabrous. Leaves coriaceous, elliptic to ovate, (4–)5–9 cm long, (2.3–)3–5.4 cm wide, apex and base obtuse, decurrent on the petiole, nitid above, pallid and scrobiculate below, the midrib impressed above, prominently raised below, the secondary venation obscure, conspicuously black punctate and punctate-lineate, the margin membranous, hyaline, revolute, prominently black punctate, glandular-ciliate at first when young, glabrescent, entire; petiole canaliculate, 0.4–0.9 cm long, glabrous. Staminate inflorescence: unknown. Pistillate inflorescence: an umbelliform glomerule, 4–9-flowered, the peduncle glabrous, epunctate, 1.7–2.5 mm long, built up by a series of floral bract bases; floral bracts obovate, 0.5–0.6 mm long, 0.9–1 mm wide, apex obtuse, the margin entire, densely glandular-ciliate; pedicels cylindrical, 1–1.5 mm long, accrescent in fruit to 2(–2.5) mm long, glabrous, brown punctate. Flowers 5-merous; calyx chartaceous, cupuliform, erect, translucent, unequally divided, 1.6–1.8 mm long, the tube 0.6–0.8 mm long, the lobes 1.1–1.3 mm long, apex long-acuminate, glabrous, medially brown punctate, and prominently keeled, the margin hyaline, roughly dentate, highly irregular, glabrous; corolla chartaceous, campanulate, 2.8–3.2 mm long, translucent, the tube 0.8–1 mm long, the lobes linear-lanceolate, 2–2.4 mm long, 1.2–1.4 mm wide, asymmetric, apex acute, medially brown punctate, the margin glandular-granulose; staminodes 1.9–2 mm long, the anthers appearing epipetalous, filaments thin, hyaline, 0.1–0.3 mm long, the anthers widely ovate, 1.2–1.5 mm long, 0.9–1.0 mm wide, the apex apiculate, the base deeply cordate, the connective epunctate; pistil obnapiform, ca. 1.5 mm long, 1 mm diam., the ovary 0.8 mm long, costate, densely pellucid punctate, glabrous, the style 0.2 mm long, costate, the stigma prismatic, 0.5 mm long, 2–3-lobed, the placenta hemispherical, the ovules 3, completely imbedded. Fruit globose, 3–5 mm length and diam., densely pellucid punctate.

Distribution. Endemic to the upper slopes of Cerro de la Neblina, 1,780–2,200 m.

Paratypes. VENEZUELA. TERRITORIO FEDERAL AMAZONAS: Depto. Río Negro, Cerro de la Neblina, Camp 9, 1.2 km NE of waterfall on E headwaters of Río Mawarinuma, 1°00′N, 65°53′W, 1,780–1,820 m, 2 Feb. 1985 (fr), *B. Boom et al. 5535* (NY, US, VEN), Valle de Titricó, N of Pico Phelps, 0°56′N, 65°58′W, 2,200 m, 1 Dec. 1984 (fr), *T. Croat 59551* (MO, VEN), E escarpment of upper Caño Grande, 2,200 m, 14 Dec. 1957 (pist. fl, fr), *B. Maguire, J. Wurdack & C. Maguire 42403* (F, MO, NY, US, VEN).

Myrsine maguireana is one of several species of the genus known to have rudimentary filaments in the flowers. The presence of these filaments in a few South American taxa, and their frequency in Pacific ones, renders recognition of *Rapanea* as distinct from *Myrsine* untenable.

Myrsine picturata Pipoly, sp. nov. TYPE: Venezuela. Territorio Federal Amazonas: Cerro de la Neblina, S rim of upper basin of Caño Grande. 1,200–2,200 m, 13 Dec. 1957 (pist. fl, fr), *B. Maguire, J. Wurdack & C. Maguire 42375* (holotype, VEN; isotypes, F, MO, NY, US). Figure 2.

Quoad ramulos glabros, folia coriacea elliptica vel oblonga apice obtusa vel emarginata, necnon inflorescentias glomerulatas, ad *M. parvifoliam* A. DC. valde affinis, sed ab ea petiolis (0.7–)0.8–1 (non usque ad 0.5) mm longis, pedicellis gracilibus 0.9–1 (nec crassis 1–2) mm longis, calycis lobis secus marginem glabris (nec ciliolatis) necnon corollae lobis secus marginem perdense glandulari-gran-

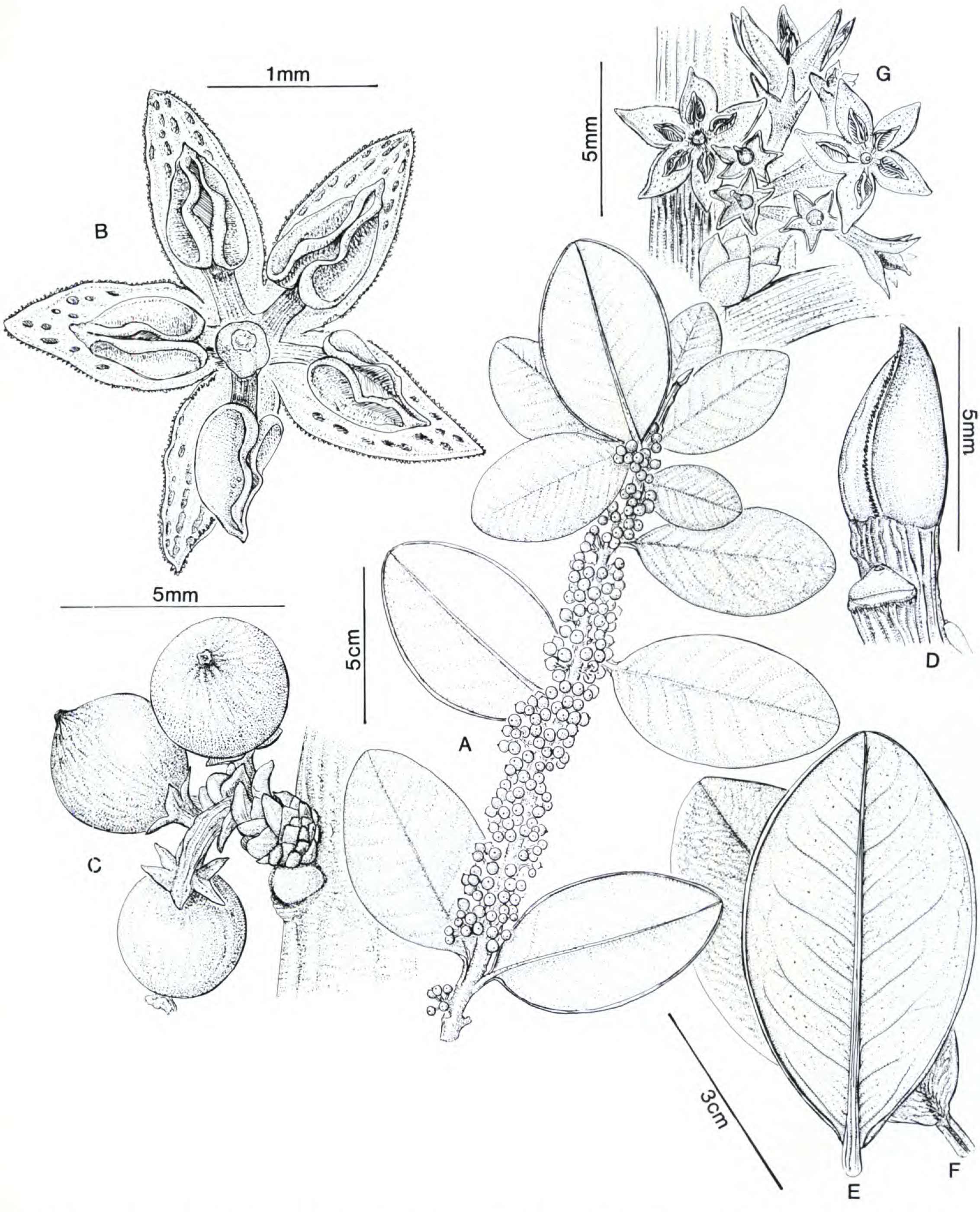

Figure 1. *Myrsine maguireana* Pipoly. —A. Habit. —B. Pistillate flower, showing filaments, apiculate anthers, and costate ovary. —C. Infructescence. —D. Apical bud, showing ciliate leaf margins. —E. Leaf, abaxial surface, showing revolute margin, scrobiculate surface, and obtuse apex and base. —F. Leaf, Adaxial surface, showing sunken costa and canaliculate petiole. —G. Pistillate inflorescence. A–G, drawn from type.

ulosis (nec glabris) atque scilicet antheris apiculatis (nec acutis) statim separabilis.

Tree to 8 m tall; branchlets terete, 4–5 mm diam., glabrous. Leaves coriaceous, elliptic to oblong, (3–)4–6 cm long, (1.5–)1.8–2(–3) cm wide, apex obtuse to slightly emarginate, base cuneate, decurrent on the petiole, nitid above, pallid below, prominently and densely black punctate and short-lineate,

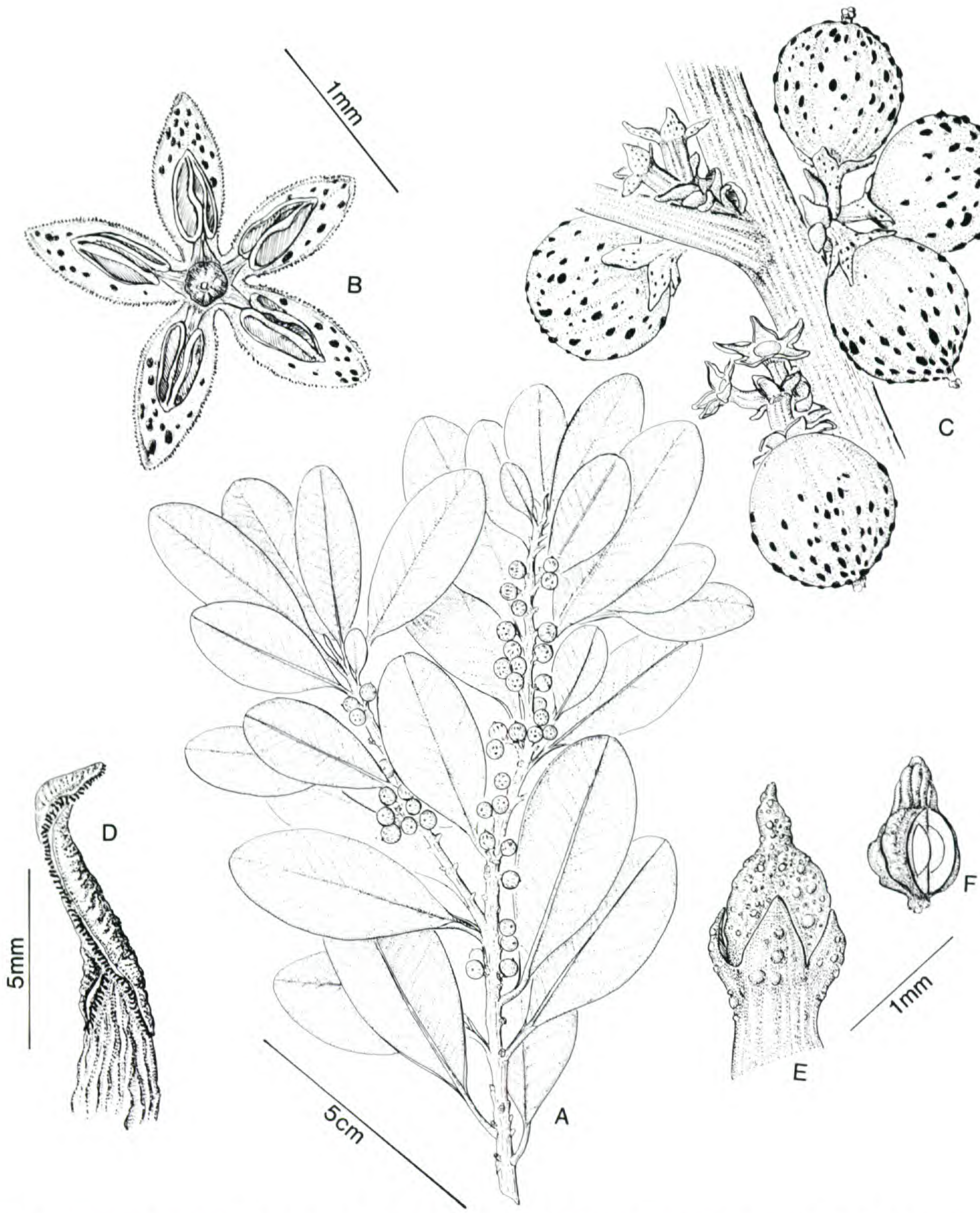

Figure 2. *Myrsine picturata* Pipoly —A. Habit. —B. Pistillate flower, showing filaments, glandular-granulose calyx lobe margins, and apiculate anthers. —C. Infructescence, showing prominently raised black punctate-lineations. —D. Apical bud, showing glandular-ciliate leaf margin. —E. Developing fruit, showing prominently raised punctations. —F. Pistil, showing ovules imbedded in placenta. A–F, drawn from type.

translucent glandular-lepidote above in bud, glabrescent; the midrib strongly impressed above, raised and ribbed below, the margin revolute, entire, hyaline, with prominently raised black punctations, densely red glandular-ciliate in bud, glabrescent; petiole canaliculate, (0.7–)0.8–1 cm long, glabrous. Staminate inflorescence: unknown. Pistillate inflorescence: glomerulate, 3–5-flowered, the peduncle glabrous, epunctate, 1.2–2.1 mm long; floral bracts membranaceous, very widely ovate to deltate, 0.7–1.0 mm long, 0.8–1.2 mm wide, apex obtuse, densely and prominently black punctate and punctate-lineate, the margin entire, glandular-ciliate; pedicels cylindrical, 0.9–1.0 mm long, glabrous, densely and prominently black punctate-lineate. Flowers 5-merous, translucent green; calyx chartaceous, cotyliform, 1.3–1.5 mm long, the tube 0.1–0.2 mm long, the lobes ovate, 1.1–1.2 mm long, 0.6–0.8 mm

wide, apex long-attenuate, glabrous, densely and prominently black punctate-lineate, medially crassate, the margin hyaline, flat, irregular, glabrous; corolla membranaceous, campanulate, 1.8–2.0 mm long, the tube 0.5–0.6 mm long, the lobes ovate, 1.2–1.4 mm long, 0.6–0.7 mm wide, apex rounded to obtuse, densely and prominently black punctate and punctate-lineate, hyaline, the margin densely glandular-granulose, entire; staminodia 1.2–1.4 mm long, the filaments obsolete to 0.1 mm long, the anthers ovate, 0.9–1 mm long, 0.3–0.4 mm wide, apex apiculate, base sagittate, epunctate, but the connective darkened dorsally; pistil ellipsoid, 2.1–2.4 mm long, the ovary 1.5–1.8 mm long, 1.0–1.2 mm diam., densely and prominently black punctate and punctate-lineate, the stigma subsessile, conical, ca. 0.6 mm long, 2–3-lobed longitudinally, pellucid punctate, apically cuspidate, ovules 3, immersed in a globose placenta. Fruit obovoid, 4–5 mm long, 3–3.5 mm diam. when dried, densely and prominently black punctate and punctate-lineate.

Distribution. Endemic to the upper slopes of Cerro de la Neblina, 1,730–1,850 m.

Paratypes. VENEZUELA. TERRITORIO FEDERAL AMAZONAS: Cerro de la Neblina, Cumbre Camp, 2,200 m, 19 Nov. 1957 (fr), *C. Maguire, J. Wurdack & C. Maguire 42090* (F, NY, US, VEN); Camp VII, 00°52′N, 65°58′W, 1,730–1,850 m, 10 Feb. 1985 (fr), *S. Renner 2096* (AAU, MO, NY, US).

Myrsine perpauciflora Pipoly, sp. nov. TYPE: Venezuela. Territorio Federal Amazonas: Cerro de la Neblina, Camp VII, 5 km NE of Pico Phelps, 00°50′40″N, 65°58′10″W, 1,850 m, 1 Feb. 1985 (fr), *M. Nee 30697* (NY, US, VEN). Figure 3.

Propter ramulos petiolos laminasque glabros necnon laminas chartaceas asymmetricasque desuper nitidas subtus obscure atro-punctato-lineatas, atque calycis lobos latissime ovatos glandulari-ciliatosque ad *M. lancifoliam* Martius affinis sed ab ea laminis desuper laevibus (non scrobiculatis) calycis lobis manifeste (nec obscure) brunnei punctatis, calycis loborum sinibus punctatis (nec epunctatis) necnon inflorescentiis 1–3(nec 5–14)-floribus facile cognoscitur.

Tree to 4 m tall; branchlets terete, 2.5–3 mm diam., glabrous. Leaves chartaceous, oblanceolate to elliptic, (4–)4.8–5.5(–6) cm long, (1.5–)1.8–2 cm wide, apex acute, base cuneate, decurrent on the petiole, asymmetric, somewhat nitid above, pallid and black punctate-lineate below, midrib impressed above, prominently raised and brown punctate-lineate below, the margin revolute, translucent but not hyaline, entire, brown punctate, glandular-ciliate at first, early glabrescent; petiole marginate, 0.3–0.5 mm long. Staminate inflorescence: unknown. Pistillate inflorescence: unknown. Infructescence: glomerulate, apparently 1–3-flowered, the peduncle glabrous, epunctate, (1.2–)1.6–2.4 mm long; floral bracts orbicular, 0.8–1 mm long, 0.8–1 mm wide, apex obtuse, densely pellucid punctate, the margin densely erose-ciliate; pedicels cylindrical, 1.2–2 mm long, glabrous, sparsely pellucid punctate-lineate. Fruiting calyx chartaceous, unequally divided, 1.2–1.3 mm long, translucent, densely and prominently brown punctate and punctate-lineate, with darkened glandular areas at the calyx lobe/tube sinus, the tube 0.2–0.3 mm long, the lobes very widely ovate to deltate, 1–1.2 mm long, 0.8–1 mm wide, apex acute, prominently brown punctate and punctate-lineate, flat, the margin hyaline, entire, densely glandular-ciliate. Fruit globose, 3–5 mm long and in diam., when dried, densely pellucid punctate and punctate-lineate.

Distribution. Known only from the type.

Myrsine macrocarpa Pipoly, sp. nov. TYPE: Venezuela. Territorio Federal Amazonas: Serranía Parú, Río Parú, Cerro Parú, valley above camp and valley draining eastward through cumbre, 2,000 m, 10 Feb. 1951 (fr), *R. Cowan & J. Wurdack 31372* (holotype, VEN; isotypes, F, NY, US). Figure 4.

Ob ramulos crassos, laminas coriaceas necnon ellipticas vel obovatas, inflorescentias paucifloras ad *M. latifoliam* (Ruíz et Pavon) Sprengel f. simulans sed ab ea laminarum nervis secundariis manifeste 13–26-jugis (non obscuris) subtusque laminis obscure pellucido-punctatis (non praesertim permanifeste denseque atro-punctatis) pedicellis 1–1.4 (non 2–2.5) mm longis, calycis lobis secus marginem glabris (non ciliolatis) denique fructibus 0.8–1.2 (nec 0.5–0.7) cm diametris nunquam non praesertim dignoscenda.

Tree 7 m tall; branchlets terete, 7–10 mm diam., glabrous. Leaves coriaceous, elliptic to obovate, 9.5–16 cm long, 6.5–9.2 mm wide, apex obtuse, base acute, decurrent on the petiole, pallid and scrobiculate above and below, midrib impressed above, prominently raised below, the secondary vein pairs 13–26, visible above and below, not evidently punctate, the margin opaque, highly revolute basally, glabrescent, entire; petioles marginate, 1.5–2 cm long, glabrous. Staminate inflorescence: unknown. Pistillate infloresecence: unknown. Infructescence: glomerulate, apparently 4–8-flowered, the peduncle glabrous, epunctate, 1.2–4.2 mm long, made up of floral bract bases; floral bracts very widely ovate, 0.5–0.7 mm long, 1.0–1.2 mm wide, apex obtuse, densely pellucid punctate, the margin entire, densely glandular-ciliate; pedicels cylindrical, 1.1–1.4 mm long, glabrous, epunctate. Flowers unknown. Fruit-

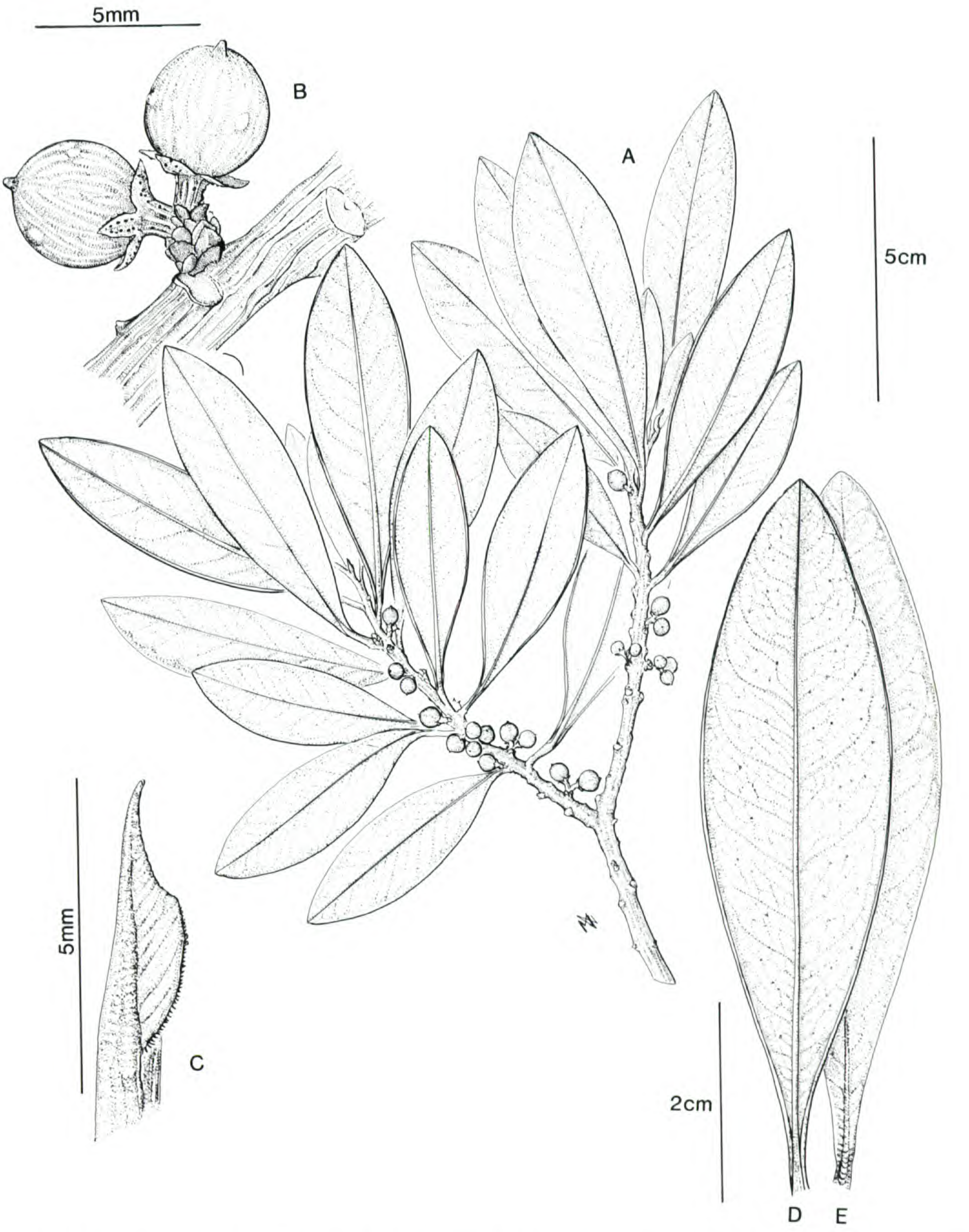

Figure 3. *Myrsine perpauciflora* Pipoly. —A. Habit. —B. Infructescence. —C. Apical bud, showing glandular-ciliate leaf margin. —D. Leaf, abaxial view. —E. Leaf, adaxial view. A–E, drawn from type.

ing calyx cotyliform, coriaceous, 1.2–1.4 mm long, the tube 0.2–0.3 mm long, the lobes very widely ovate to subdeltate, 1.0–1.2 mm long, 1.1–1.3 mm wide, the apex acute, densely pellucid punctate, the margin irregular, opaque, entire, glabrous. Fruit globose, 0.8–1.2 cm long and in diam., purplish at maturity, inconspicuously punctate.

Distribution. Known only from the type.

The treatment of *Rapanea* Aublet as a taxonomic synonym of *Myrsine* Linnaeus necessitates the following new combinations.

Myrsine roraimensis (A. C. Smith) Pipoly, comb. nov. Basionym: *Rapanea roraimensis* A. C.

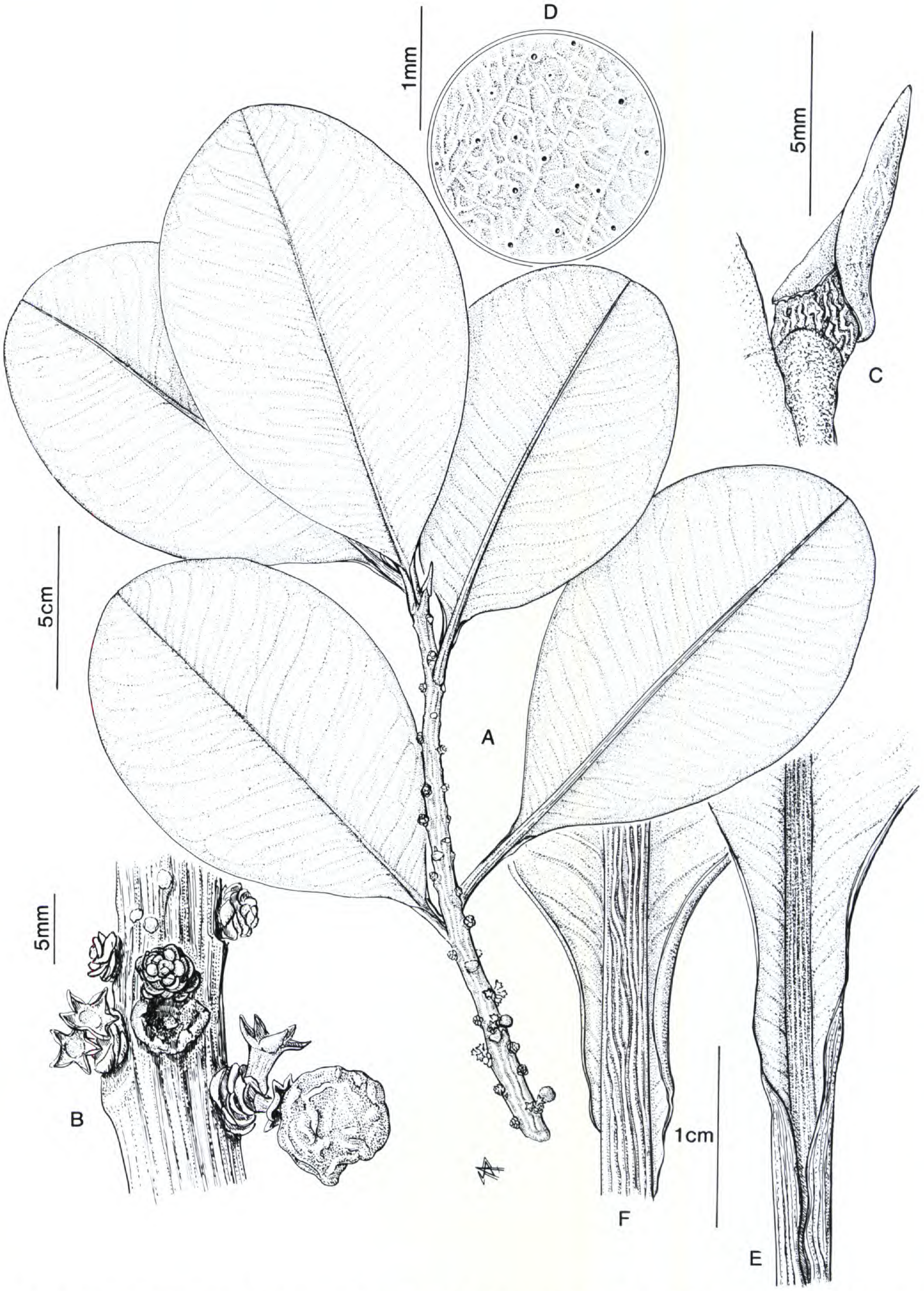

Figure 4. *Myrsine macrocarpa* Pipoly. —A. Habit. —B. Infructescence. —C. Apical bud, showing glabrous leaf margin. —D. Close-up of abaxial leaf surface, showing scrobiculate surface. —E, F. Petiole, showing decurrent leaf blade. A–F, drawn from type.

Smith, Bull. Torrey Bot. Club. 67: 296. 1940. TYPE: Venezuela. Bolívar: Mt. Roraima, 11 Jan. 1939 (stam. fl), *Pinkus 132* (holotype, NY; isotypes, F, GH).

Myrsine nitida (Mez) Pipoly, comb. nov. Basionym: *Rapanea nitida* Mez, Repert. Spec. Nov. 16: 424. 1920. TYPE: Guyana. Mt. Roraima, (stam. fl), *Ule 8725* (holotype, B-destroyed; neotype, to be designated).

Myrsine nitida is closely related to *Myrsine roraimensis*, but differs in its punctate-lineate (not punctate) calyx lobes, anthers much shorter than (rather than subequaling) the petals, with very wide (not narrow) longitudinal anther dehiscence slits. In addition, the densely lenticellate bark of *M. nitida's* branchlets easily sets it apart from *M. roraimensis*.

Myrsine resinosa (A. C. Smith) Pipoly, comb. nov. Basionym: *Rapanea resinosa* A. C. Smith, Bull. Torrey Bot. Club. 67: 1940. TYPE: Venezuela. Bolívar: Río Arabapu, near Arabapu, 4,200 ft., 17 Jan. 1939 (pist. fl), *Pinkus 84* (holotype, NY; isotypes, F, GH).

An exceedingly rare species, known from fewer than a dozen gatherings, this species has also been collected from the Guayana of adjacent Guyana.

Myrsine coriacea (Sw.) R. Br. ex Roemer et Schultes in Linnaeus subsp. **reticulata** (Steyermark) Pipoly, comb. et stat. nov. Basionym: *Rapanea reticulata* Steyermark, Fieldiana, Bot. 28: 477. 1953. TYPE: Venezuela. Bolívar: Cerro Roraima, between Rondón Camp and base of sandstone bluffs, 2,040–2,255 m, 30 Sep. 1944 (pist. fl), *J. Steyermark 58983* (holotype, F; isotypes, NY, US, VEN).

Stearn (1969) lectotypified and discussed the complete synonymy of *Myrsine coriacea* in his treatment of the Myrsinaceae for the *Flora of Jamaica*. Lundell (1971) treated the Central American populations as distinct from those of the Caribbean, referring them to *Rapanea myricoides* (Schlechtendal) Lundell (= *Myrsine myricoides* Schlechtendal). *Rapanea ferruginea* (Ruíz &Pavon) Mez (= *Myrsine ferruginea* (Ruíz &Pavon) Sprengel f.) was the name used for the South American taxa (Macbride, 1959). After conducting field studies of populations in Nicaragua, Costa Rica, Panama, Colombia, Venezuela, and Ecuador, I treat *M. ferruginea* as a synonym of *M. coriacea* because the differences in punctation alluded to by Lundell (1971) are often found in one locality along an elevation/exposure gradient. The type of *Rapanea reticulata* represents populations throughout the Guayana Floristic Province that have smaller leaves, inflorescences 2(–3)-flowered (not (3–)5–9(–11)-flowered), with calyx lobes deltate (not longer than wide). *Myrsine coriacea* in its entirety is defined by its autapomorphic morchelliform stigma.

Myrsine minima (Steyermark) Pipoly, comb. nov. Basionym: *Rapanea minima* Steyermark, Fieldiana, Bot. 28: 477. 1953. TYPE: Venezuela. Bolívar: summit, Cerro Roraima, 2,620–2,740 m, 27 Sep. 1944 (stam. fl), *J. Steyermark 58848* (holotype, F; isotypes, NY, VEN).

The type of *M. minima* is characteristic of populations from the exposed margins of cloud forests, characterized by shorter, more orbiculate leaves with obtuse bases. Those populations from protected, more shaded areas inside cloud forests have more elongate, oblong to obovate leaves with subacute bases.

Myrsine guianensis (Aublet) O. Kuntze (= *Rapanea guianensis* Aublet) is common in Territorio Federal Delta Amacuro, and the lowland areas of adjacent Bolívar. It appears that the cork cambium of the northern South American populations is much more active than that of the Mesoamerican and Caribbean populations once referred to this taxon. The correct name for the Caribbean and Mesoamerican, lowland coastal species is *Myrsine floridana* A. DC.

Doubtful and Excluded Taxa

Myrsine schomburgkiana Miquel in Martius, is actually *Elaeoluma schomburgkiana* (Miquel) Baillon (Sapotaceae), according to Pennington (1990). *Rapanea duidae* Gleason, Bull. Torrey Bot. Club 58: 447. 1931, is actually a species of *Micropholis* (Sapotaceae).

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Novae Gesneriaceae Neotropicarum III. Additional New Species from Venezuela

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Expeditions to remote areas of Venezuela and preliminary preparation of the treatment of Gesneriaceae for the *Flora of the Venezuelan Guayana* by Julian Steyermark revealed several new species. Further work on the family for the *Flora* is being carried out by Christian Feuillet and is expected to yield additional new species.

Besleria parviflora L. E. Skog & Steyermark, sp. nov. TYPE: Venezuela. Bolívar: Chimantá Massif, along stream in quebrada, forested slopes along trail between Camp 2 and Camp 3, northwestern part of Abácapa-tepuí, 750–1,100 m, 5 Apr. 1953, *Steyermark 74810* (holotype, VEN; isotypes, F, NY, US). Figure 1.

Besleriae solanoidi Kunth affinis sed marginibus foliorum integris vel subintegris lobis calycis brevioribus subacuminatis corollis 6–7 mm longis albis differt.

Large, single-stemmed, terrestrial, suffrutescent herbs; stems erect, 0.7–1.5(–2) m tall, strigillose near apex, glabrescent below, internodes 3–6 cm long. Leaves nearly equal in a pair, petiolate; blades oblong to ovate-elliptic, 13.5–26.5 × 4.7–7.9(–9) cm, subcoriaceous, apex acuminate or acute, base acute to cuneate, margin minutely denticulate toward the apex or entire and remotely undulate, lateral veins 5–6 on each side 12–20 mm apart, the uppermost lateral vein 4.5–7.5 cm below the apex, dark green, glabrous to puberulent adaxially, pale green, mainly glabrous but with numerous obscure circular scales and strigillose along the veins and margins abaxially; petioles 1.3–4.5 cm long, densely appressed-pubescent. Inflorescences of 5–8 flowers congested or fasciculate in the upper axils; peduncles obsolete or to 3 mm long, densely pubescent; bracts lacking; pedicels slender, 2–5 mm long, densely pubescent. Flowers very small; calyx lobes connate for ¼–⅓ of their length, lanceolate to ovate, 1–3(–4) mm long, 0.9–2 mm wide at base (lower lobe slightly smaller), green, apex acute to acuminate, outer surface with sordid adpressed pubescence at base along the midvein but pubescence terminating below apex, sessile glands dispersed on surface, glabrous within; corolla creamy white to greenish yellow to yellow, short-tubular, lacking spur, 6–7 mm long, 1.5 mm wide at base, 3 mm wide at mouth, outer surface minutely puberulent, minutely papillate-puberulent at mouth, glabrous below, lobes 2–2.5 mm long and wide, pale white or dull maroon with upper 2 lobes maroon, lower lobes pale yellow; stamens didynamous, filaments broadened at base, adnate to corolla base for 1.5 mm, shorter pair 2.5 mm long, longer pair 3.5–4 mm long, glabrous, anthers broader than long, 0.3 × 0.8 mm, staminode between the bases of the shorter filaments, linear-ligulate, 0.8 × 0.2 mm, sterile anther 0.1 × 0.1 mm; disc annular, 0.5 × 1.2 mm, sublobulate at summit; ovary ovoid, 2 × 1.2 mm, glabrous, style 1.7 mm long, glabrous. Berry ovoid to globose, 3–4 mm long and wide, yellowish, dull orange to reddish, glabrous; seeds broadly fusiform, ca. 0.5 × 0.3 mm, striate.

Distribution. Besleria parviflora is distributed near streams in wet forests in Bolívar and Amazonas, Venezuela, at 450–1,300 m.

Additional specimens examined. VENEZUELA. BOLÍVAR: Munic. Raul Leoni, 78 km S of Uriman-tepuí, vicinity of small summit of sandstone, 4°39′N, 62°36′W, 450 m, Sep. 1986, *A. Fernandez 3449* (MO); 17 km E of El Paují, 64 km W of Santa Elena, Río Las Ahallas, 4°30′N, 61°30′W, 850 m, 30 Oct. 1985, *Liesner 19202* (MO, US); 4 km W of El Paují, 2–5 km N of road, Río Chaberú, 4°30′N, 61°36′W, 12 Nov. 1985, *Liesner 19932* (MO, US, VEN); Dist. Piar, Amaruay-tepuí, slope up to base wall, S side about 1 km from SW corner of tepui, 20–35 m tall forest, 5°54′N, 62°15′W, 550–810 m, 25 Apr. 1986, *Liesner & Holst 20313* (MO), 26 Apr. 1986, *20386* (MO); rocky hematite exposures on open slopes on summit at W end of Sororopán-tepuí, 2,225–2,255 m, 13 Nov. 1944, *Steyermark 60052* (F, US); Sierra de Lema, headwaters of Río Chicanán, 80 km SE of El Dorado, 6°5′N, 62°W, 690 m, 22 Aug. 1961, *Steyermark 89386* (VEN); along small stream in quebrada, between Río Paramichí and Salto de Chalimano, SE toward Venezuela–Brazil frontier, NW of Serranía Pia-soi (Pia-shauhy, Pia-Savi), 4°52′N, 62°58′W, 525–650 m, 5 Jan. 1962, *Steyermark 90609* (US, VEN); Venezuela–Brazil frontier, NE of Serranía Pia-soi (Pia-savi), 3°53′N, 62°46′W, 650–800 m, 5–6 Jan. 1962,

2mm
B
G
1mm
1mm
H
1mm
C
D
1mm
A
1cm
AR Tangerini
F
1mm
E

Steyermark 90653 (US, VEN). TERRITORIO FEDERAL AMAZONAS: Sierra Parima, 45 km NW of headwaters of Río Orinoco, along Venezuela–Brazil frontier, 2°27′24″N, 63°56′W, 1,300 m, 18–23 May 1972, *Steyermark 106014* (VEN); Upper Orinoco, *Croizat 889* (NY), *1044* (NY).

In Morton's key to the Venezuelan species of *Besleria* (1953), *B. parviflora* resembles in habit the widespread *B. solanoides* Kunth, but the latter differs mainly in having an orange corolla 13–15 mm long. The new species can be characterized by entire to subentire leaf blades, shorter subacuminate calyx lobes, and corollas that are 6–7 mm long, white to cream or greenish yellow (rarely with some maroon), and are minutely puberulent externally. Another species that resembles *B. parviflora* is *B. flavo-virens* Nees & C. Martius, originally described from Brazil, but more common in the Guianas and recently also found in Costa Rica. That species has white corollas and longer peduncles and pedicels.

Drymonia pudica L. E. Skog & Steyermark, sp. nov. TYPE: Venezuela. Aragua: Pittier National Park, rich cloud forest in portion of gradual ascent halfway up Fila de Paraiso, between Portachuelo and summit, 1,400 m, 5 July 1963, *Steyermark 91529* (holotype, VEN; isotype, US). Figure 2.

Drymoniae crassae C. Morton affinis, sed foliis longioribus (5–17 cm longis) corollis in faucibus maculatis venis loborum purpureis vel roseis bracteis ellipticis vel ovatis longioribus et latioribus (2–4 × 1.5–2.5 cm) differt.

Woody lianas climbing over small trees, into the crowns of larger trees, and clambering over boulders; stems ± terete, glabrous, internodes 1–10 cm long, 3–8 mm diam., green to brown; branches occasional. Leaves subequal in a pair, petiolate; blades elliptic, oblong to obovate, 5–17 cm long, 2–6 cm wide at widest point, coriaceous, apex acuminate, base acute, margin entire to serrulate, veins pinnate, 4–6 on each side, prominent on lower side, deep or rich green, shiny, glabrous adaxially, pale green with a flesh-colored midrib or silvery, glabrous abaxially; petioles 0.5–3.0 cm long, 1–3 mm diam., glabrous. Inflorescences shorter than the leaves, few-flowered, congested in upper axils; peduncles lacking; bracts present and obvious, elliptic to ovate, 2–4 × 1.5–2.5 cm, basal bracts pale green outside, those above pinkish, inside rose-wine, or lavender or deep purple veins with green margins; pedicels curved at apex, ca. 2 cm long, 4–5 mm diam., dull wine-red to lavender. Flowers showy; calyx lobes divided almost to base, size and shape similar to the bracts, but for the somewhat smaller dorsal lobe, pale green outside with red-purple veining, inside a rich orchid-purple to wine-red with darker veins; corolla white, limb yellow with purple spots outside, inside purple dotted or lined, lobes veined purple or rose; stamens adnate to corolla base, filaments connate above attachment to corolla, coiling after anthesis; disc a single posterior nectariferous gland; ovary ovoid, glabrous. Fruit a fleshy capsule, broadly ovoid, ca. 3.2 × 2.2 cm, buff-flesh-colored to dull purple; seeds fusiform, ca. 1.0×0.4 mm, with the fleshy funiculus persistent, striate.

Distribution. Drymonia pudica is known in Venezuela from the states of Aragua, Carabobo, and Yaracuy, where it has been collected at 900–1,400 m in shady sites in rich cloud forests, flowering from March to August.

Additional specimens examined. VENEZUELA. ARAGUA: Pittier National Park, between Rancho Grande and Dos Riitos, 900 m, 19–20 May 1943, *Killip & Lasser 37765* (US, VEN); km 24, June 1938, *Williams 10209* (F, F, US); Ocumare–Maracay, 1 Aug. 1925, *Pittier 11858* (A, G, K, US). CARABABO: electric plant at Borburata, Aug. 1960, *Aristeguieta 4367* (US); Upper Guaremales, road from Puerto Cabello to San Felipe, 100–500 m, 15 July 1920, *Pittier 8959* (US); Río San Gián, S of Borburata, above the electric plant, between Los Tanques and La Toma, 750 m, 27–28 Mar. 1966, *Steyermark & Steyermark 95153* (F, US). YARACUY: El Amparo, N of Salóm, Santa Rosa road, 1,200 m, 27 May 1973, *Diederichs 229* (VEN); El Amparo near Candelaria, 7 km N of Salóm, 1,220–1,250 m, 17–19 June 1972, *Steyermark 106278* (F, NY, US, VEN).

Leeuwenberg (in litt.) noted that Decaisne as early as 1849 had indicated this taxon to be different by citing specimens (e.g., *Linden 547* (not seen by us)) under the name "Macrochlamys guttatus." Up to the present this latter name has not been validly published, although plants under the name "Drymonia guttata" have been in cultivation since 1963, when Steyermark introduced material from the type number. Plants were first grown in cultivation at the New York Botanical Garden under NYBG accession 486/85 and at Cornell University as G-1080. George Bunting collected material of *Drymonia pudica* from

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Figure 1. *Besleria parviflora.* —A. Habit. —B. Lower leaf surface. —C. Flower buds. —D. Flower. —E. Opened corolla with stamens. —F. Pistil and nectariferous disc. —G. Mature berry. —H. Seeds. (A–F from *Steyermark 74810;* G, H from *Steyermark 60052.*)

Figure 2. *Drymonia pudica*. —A. Habit. —B. Flower. —C. Flower (face view). —D. Corolla cut open, with stamens, nectariferous gland and pistil. —E. Capsule. —F. Seeds. (A from living material and *Steyermark 91529;* B, C from *Steyermark 106287;* D from *Killip & Lasser 37765;* E, F from *Steyermark 91529.*)

Pittier National Park in Venezuela in 1968 and sent it to Cornell University where it was grown as G-1292. Plants of this species are still in cultivation from both the Steyermark and the Bunting collections.

No flowers have been seen on *Drymonia pudica* cultivated in temperate regions, hence the specific epithet.

Another endemic Venezuelan species, *Drymonia crassa* C. Morton (1953), differs in having white fleshy corollas with undistinguished calyx lobes that

are green with lilac margins, 25 × 9–12 mm, leaves densely hirtellous or puberulous on the veins below, 5–8 × 1.5–3.0 cm, bracts linear oblong, ca. 20 × 5 mm, entire, and pilose.

Nautilocalyx arenarius L. E. Skog & Steyermark, sp. nov. TYPE: Venezuela. Territorio Federal Amazonas: white sand savanna and dwarf forest, 1 km E of Maroa, 2°45′N, 67°35′W, 125 m, 20 Apr. 1970, *Steyermark & Bunting 102830* (holotype, VEN; isotypes, MO, US). Figure 3.

Nautilocalyci whitei Rusby affinis, sed plantis arenariis, foliis in pagina inferiore venis pubescentia ravida sericea tectis, floribus 2–4 in axillis differt.

Low, spreading, terrestrial suffrutescent herbs; stems brittle, 6–10 cm long and 3–4 mm wide, densely sericeous, several branched from the base. Leaves subsessile or shortly petiolate, 4–6 pairs on each stem; blades narrowly elliptic-lanceolate or oblanceolate, 7.5–10 × 0.7–22 cm, apex acute, base narrowly acute and decurrent onto the inconspicuous petiole, softly coriaceous, lateral veins strongly ascending toward apex at an angle of 60–70°, scarcely evident but concealed by densely gray-pale sericeous pubescence abaxially, veins abaxially obsolete with surface dull green, minutely and densely pubescent, margin minutely and inconspicuously crenulate-serrulate with 30–35 low glandular obtuse projections (these end in a flat tip with a depressed part) along the upper ⅔ of the blade; petioles, when present, 5–10 × 2–3 mm, densely sericeous. Inflorescences axillary, densely flowered, with 2–4 flowers in fascicles on each side; bract subtending each side of a flower cluster, ovate to lanceolate-elliptic, 1.2–2.0 × 0.6–0.8 cm, acute at apex, narrowed to the base, glabrous adaxially, tomentose abaxially; pedicels absent or to 11 mm long, densely tomentose. Flowers with the calyx conspicuously gamosepalous, 18–20 mm long, tube campanulate, 10–15 mm long, asymmetrically rounded at base and slightly gibbous on dorsal side, 0.7 cm wide at base, 1.2 cm wide at summit, pale green, moderately to densely villosulous outside, minutely sparsely appressed-pubescent inside, lobes unequal, ovate-lanceolate, 10–11 mm long, 5 mm wide below, narrowed apically, subobtuse or obtusely acute, with a shorter intermediate lobe, densely pubescent outside, sparsely appressed inside below apex, glabrescent within below, upper margins of the larger lobes with repand subglandular enlargements; corolla mostly white, suffused with purple, 4.7–5 cm long, tube 3.8–3.9 cm long, 0.4 cm wide at base, 0.7–0.9 cm wide at middle, 0.8–1.0 cm wide at mouth, dorsally villous at base, appressed-pubescent elsewhere, limb ca. 2.3 cm wide, larger lobes suborbicular, 1 × 0.7–0.8 cm, rounded, pink-tinged, appressed-pubescent outside on lower part, glabrous elsewhere, glabrous and pink dotted within, the smaller lobes densely appressed-pubescent outside, inside glabrous; stamens included, filaments glabrous, anthers reniform-suborbicular, 2 × 2 mm, bilobed, rounded at summit; disc of a single bilobed gland, ovoid-oblong, 1.8–2.0 × 1.5–1.8 mm, with a sulcate longitudinal groove medially; ovary slenderly ovoid, densely sericeous-tomentose, style densely pilose with spreading hairs ca. 1 mm long. Fruit not seen.

Distribution. Nautilocalyx arenarius is apparently very limited in distribution but locally common near San Carlos de Río Negro in Territorio Federal Amazonas, Venezuela, except for the type specimen collected near Maroa. All collections were growing at about 120 m elevation in low forest on white sand.

Vernacular names. "Jabilla" (Baré language), "gordura" (Spanish) (both *Clark 6617*).

Additional specimens examined. VENEZUELA. TERRITORIO FEDERAL AMAZONAS: Distr. Río Negro, 3 km NE of San Carlos de Río Negro, ca. 20 km S of confluence of Río Negro and Brazo Casiquiare, 1°56′N, 67°03′W, 119 m, 31 Dec. 1977, *Clark 6464* (MO, NY, US, VEN); 10.8 km NE of San Carlos on Solano road, ca. 20 km S of confluence of Río Negro and Brazo Casiquiare, 1°56′N, 67°03′W, 119 m, 19 Apr. 1978, *Clark 6617* (NY); km 11 NE of San Carlos de Río Negro along road to Solano, 1°53′N, 67°02′W, 75 m, 24 June 1984, *Davidse & Miller 26552* (MO, US); San Carlos de Río Negro, 20 km from the confluence of Río Negro and Brazo Casiquiare, 1°56′N, 67°W, 119 m, *Delascio et al. 9341* (VEN); 7 km from San Carlos de Río Negro along the road to Solano, 18 Nov. 1978, *Fernandez 3447* (MY); 11 km N of San Carlos on road to Solano, 1°47′N, 67°48′W, 120 m, 5 Apr. 1984, *Gentry et al. 46371* (MO, US); IVIC study area, 4 km E of San Carlos de Río Negro, 120 m, 1°56′N, 67°4′W, 120 m, 10 Nov. 1977, *Liesner 3286* (MO, US, VEN), 1 Dec. 1977, *Liesner 4132* (MO, VEN), 9 Apr. 1979, *Liesner 6417* (MO, VEN); 9 km NE of San Carlos de Río Negro, 1°57′N, 67°W, 120 m, 26 Nov. 1977, *Liesner 3907* (MO, US, VEN); San Carlos de Río Negro, Oct. 1974, *Medina s.n.* [herb. no. 223665] (VEN); 2 km N of San Carlos, along road to Solano, 6 Feb. 1977, *Morillo & Villa 5342* (VEN); 12 km N of San Carlos, 100–120 m, 6 Feb. 1977, *Morillo & Villa 5383* (VEN); 6–7 km S of Solano, 120 m, *Morillo & Villa 5448* (VEN); 1–4 km NE of San Carlos, 1°56′N 67°02′W, 100 m, 24 Apr. 1974, *Morillo et al. 3909* (VEN—2 sheets); near San Carlos de Río Negro, along road to Solano, 28 Aug. 1982, *Ruíz & Ramirez 4030* (MY); Upper Río Negro, San Carlos, 15 Dec. 1947, *Schultes & Lopez 9370* (US—2 sheets); near San Carlos, 1853–1854, *Spruce 3469* (K—2 sheets); 3 km NE of San Carlos de Río Negro along road to Solano, 120 m, 9 Apr. 1984, *Stein 1500* (MO, US); near

Figure 3. *Nautilocalyx arenarius.* —A. Habit. —B. Leaf surface. —C. Flower buds. —D. Calyx. —E. Calyx opened. —F. Flower. —G. Corolla opened, with stamens. —H. Anthers. —I, J. Pistil and nectariferous gland. (A from *Spruce 3469*; B–J from *Steyermark & Bunting 102830*, *Clark 6454*, and *Clark 6617*.)

San Carlos de Río Negro, 1°55′N, 67°W, 125 m, *Wessels Boer 2272* (US).

Nautilocalyx arenarius resembles most closely *N. whitei* Rusby from Bolivia and Peru in habit. *Nautilocalyx whitei* has leaves that are pale green below with obvious reddish veins, 1–2 flowers per axil, and corollas ca. 3 cm or less long. Plants of the latter species, however, do not grow in white sand areas, but rather in tall, wet forest at a somewhat higher elevation.

Nautilocalyx cordatus (Gleason) L. E. Skog, comb. nov. Basionym: *Episcia cordata* Gleason, Bull. Torrey Bot. Club 58: 466. 1931. TYPE: Venezuela. Amazonas: waterfall at Agüita, *Tate 878* (holotype, NY; isotypes, K, US).

Centrosolenia hirsuta Benth., London J. Bot. 5: 362. 1846 (not *Nautilocalyx hirsutus* (Sprague) Sprague). *Episcia hirsuta* (Benth.) Hanst., Linnaea 34: 350. 1865. TYPE: Guyana. Banks of the Río Parama, *Schomburgk s.n.* (holotype, K).

Distribution. Nautilocalyx cordatus is found in the Guayana Highlands of Brazil, Guyana, Surinam, and Venezuela in damp locations in montane rainforests.

Representative specimens examined. VENEZUELA. TERRITORIO FEDERAL AMAZONAS: Cerro Duida, 305–1,095 m, 25–26 Aug. 1944, *Steyermark 57996* (US, VEN); Cerro Aratitiyope, 2°10′N, 65°34′W, 990–1,670 m, 24–28 Feb. 1984, *Steyermark, Berry & Delascio 130055* (NY, US, VEN); Río Siapa, 8 km below Raudal Gallineta, 130–300 m, 20 July 1959, *Wurdack & Adderley 43504* (US—2 sheets).

Among other characters *Nautilocalyx* and *Episcia* are separated because of the presence of axillary stolons in *Episcia* and the lack of such stolons in *Nautilocalyx*. *Episcia hirsuta* had been maintained in *Episcia* because it was believed that the species is stoloniferous. However, no specimens definitely attributable to the taxon appear to have stolons, including the type specimen. Therefore, the species is here transferred to *Nautilocalyx*.

Centrosolenia hirsuta Benth., a synonym of *Nautilocalyx cordatus*, is the type species of *Centrosolenia* Benth., a generic name that predates *Nautilocalyx* Linden ex Hanst. A proposal for the conservation of *Nautilocalyx* against *Centrosolenia* has been submitted for consideration by the next botanical congress (Feuillet & Skog, 1990).

Nautilocalyx chimantensis L. E. Skog & Steyermark, sp. nov. TYPE: Venezuela. Bolívar: Chimantá Massif, common along shaded wet bluffs and by waterfall, along SW-facing sandstone bluffs and Chimantá-tepuí (Torono-tepuí), near southern corner, 1,700 m, 19–20 May 1953, *Steyermark 75473* (holotype, US; isotypes, F, VEN). Figure 4.

A *Nautilocalyce cordato* (Gleason) L. E. Skog corollarum tubis rubris angustioribus parvisque, calycum tubis parvis, lobis ligulato-oblongis, obtusis vel rotundatis, parte tertia superiore repando-dentatis differt.

Terrestrial, suffrutescent herbs; stems elongated, horizontal except at tip, and rooting at nodes, internodes along horizontal stem 4.5 cm long, 3–4 mm diam., flowering part of stem erect, 3–5 cm long. Leaves appearing alternate, petiolate; blades broadly oblong or ovate-oblong, 7–13 × 4–9 cm, apex broadly rounded or rarely subobtuse, base rounded to subcordate, margin shallowly crenate-dentate with 50–54 broadly rounded crenations 3–3.5 × 0.5 mm, the crenations either mainly similar and all broad, or the broader intercalated with smaller ones, adaxially rugose and deep green, sparsely pilosulous with pale hairs 0.5 mm long over a surface thickly covered with circular scales, abaxially pale green or wine-orchid purple, densely villous with spreading hairs 1–1.5 mm long on midrib and lateral nerves and on the tertiary veins shorter, ca. 0.5 mm long, lower epidermis also covered with numerous obscure circular scales; petioles 2.5–7 cm long, densely villous with spreading hairs 0.5–0.7 mm long. Inflorescences of 2–4-flowered fascicles in the upper axils; pedicels 2–3.5 cm long, reddish below, densely villous with spreading hairs 1–1.5 mm long. Flowers with calyx lobes ligulate-oblong, 8 × 2.5 mm, pale green, apex obtuse or rounded, shallowly 2–3 repand-dentate in upper ⅔, the repand part appearing as a subglandular protuberance pilose with hairs 0.7–1 mm long, scattered over the outer surface but absent from inner surface, hairs septate and gland-tipped; corolla deep red, tube slender, 3 cm long, gibbous at base, the spur ovate-oblong, 3 × 2 mm, tube 3–4 mm wide at base, 4–6 mm wide at summit, sparsely to moderately pilosevillosulous in dorsal portion and in ventral portion, lobes orbicular, upper three lobes larger, 10–12 × 13–17 mm, lower two lobes smaller, ca. 10 × 10 mm, all glabrous both sides, margin erose; stamens adnate to base of corolla tube for ca. 3 mm, filaments coiling after anthesis, anthers joined in two pairs, 1–2 mm long; disc of a single dorsal nectariferous gland; ovary narrowly ovoid, pilose-sericeous, style ca. 2 cm long, stigma stomatomorphic. Fruit not seen.

Distribution. Nautilocalyx chimantensis is apparently endemic to the Chimantá Massif, Bolívar, Venezuela, where it grows on exposed or wet banks.

Figure 4. *Nautilocalyx chimantensis.* —A. Habit. —B. Leaf surface. —C. Flower bud. —D. Flower. —E. Flower (face view). —F. Corolla opened with stamens. —G. Flower with corolla and stamens removed, with calyx, pistil, and nectariferous gland. (A, C–G from *Steyermark 75408;* B from *Steyermark 75473.*)

Additional specimen examined. VENEZUELA. BOLÍVAR: exposed rocky slopes of quebrada on SW-facing portions of Chimantá-tepuí (Torona-tepuí), Chimantá Massif, 1,410 m, 15 May 1953, *Steyermark 75408* (F, US, VEN).

Nautilocalyx chimantensis differs from *N. cordatus* (Gleason) L. E. Skog, which has similar-shaped leaves, in having red corollas with narrower and shorter corolla tubes, ligulate-oblong, obtuse or rounded and shorter calyx lobes that are repand-dentate in upper one-third. It differs from *N. maguirei* (described below) in having rounded or obtuse, oblong or obovate-oblong leaf blades with more depressed, rounded crenations, cordate-based and ligulate-oblong, rounded or obtuse, repand-margined calyx lobes.

Nautilocalyx fasciculatus L. E. Skog & Steyermark, sp. nov. TYPE: Venezuela. Territorio Federal Amazonas: rainforest between Camp I and Culebra, Cerro Huachamacari, Río Cunucunuma, 400 m, 21 Dec. 1950, *Maguire, Cowan & Wurdack 29982* (holotype, US; isotype, US). Figure 5.

Internodiis elongatis, nodis radicantibus, floribus axillaribus fasciculatis, lobis calycis angustis nonnullis apicibus protuberationibus 1–2 munitis, glande dorsali interiore incrassata circulari, trichomatibus omnibus septatis.

Terrestrial, suffrutescent herbs; stems erect, decumbent at base, 20–50 cm tall, 4–5 mm diam., rooting at nodes, internodes elongated, 4–9 cm long, sparsely villous with conspicuously septate hairs. Leaves petiolate; blades oblong-elliptic, 11–18 × (3.5–)4.5–7 cm, membranous, apex and base acute, margins closely low crenate-serrulate from base to apex with 45–70 teeth on each side, margins somewhat ciliate, lateral veins obscure adaxially, 10–11 on each side, ascending at 50–60° angle, faintly anastomosing at 2–3 mm from the margin or ending inconspicuously at margin, sparsely villous with septate hairs 1–1.5 mm long, more dense toward margin, otherwise glabrous, tertiary venation faintly reticulate abaxially with impressed veinlets, sparsely to moderately villous on midrib and lateral veins with hairs 1–1.5 mm long. Inflorescences of 2–5 flowers in fascicles in leaf axils; pedicels 8–20 mm long when elongated, densely villous with conspicuously septate hairs 1.2–2 mm long. Flowers with the calyx tube 2–3 mm long and wide, densely villous, lobes narrowly lanceolate or linear-lanceolate, unequal, 10–15 × 2 mm, slenderly attenuate to apex, 0.7 mm wide, densely villous with 1.5–2-mm-long conspicuously septate hairs, some of the lobes with 1 or 2 remote thickened protuberances rounded on each side; corolla red, tube narrowly infundibuliform, (3.3–)3.7–5.0 cm long, base gibbous or spurred, spur oblong, rounded, 4 × 3 mm, tube 3–4 mm wide near the base, ca. 5 mm wide near the mouth, densely septate villous outside except at glabrous base, lobes 5–6 mm long and wide, outside villous, inside glabrous; stamens included, filaments adnate to corolla base for about 9 mm above base, then free for ca. 12 mm, glabrous, anthers connate in pairs, laterally flattened and coherent, 2 × 1.8 mm, bilobate at base, round-truncate at summit; disc of a single dorsal gland, or rarely of 2 glands, the dorsal gland oblong, 1.5 × 0.9 mm, rounded and subtruncate at summit, upper median part depressed on outside, inside with a circular thickening, the second gland, when present, ventral, elliptic to acute; ovary narrowly ovoid, 4.5 × 2 mm, densely sericeous with ascending wine-red hairs, style 18–20 mm long, glabrous, stigma bilobate. Fruit an ovoid bivalved capsule surrounded by the persistent calyx; seeds ellipsoid to globose, ca. 0.7 × 0.5 mm, striate.

Distribution. Nautilocalyx fasciculatus is known only from damp forests in Territorio Federal Amazonas, Venezuela, at 400–800 m.

Additional specimens examined. VENEZUELA. TERRITORIO FEDERAL AMAZONAS: lowland and slope forests, high montane forest, 2 km S of Camp 3, Cerro de la Neblina, Río Yatua, 800 m, 24 Dec. 1953, *Maguire, Wurdack & Bunting 36874* (US); Depto. Atabapo, open and forested area around waterfall, slope of Cerro Huachamacari, 3°39′N, 65°42′W, 750 m, 6 Mar. 1975, *Liesner 18381* (MO).

Nautilocalyx fasciculatus can be distinguished by its axillary, fasciculate flowers, narrow calyx lobes with 1–2 protuberances near apex, the interior of dorsal gland with a circular thickening, the strongly septate hairs throughout, and elongated internodes.

Nautilocalyx maguirei L. E. Skog & Steyermark, sp. nov. TYPE: Venezuela. Bolívar: Cerro Guaiquinima, Río Paragua, on wet rock face of second escarpment in mixed forest, 1,100 m, 14 June 1952, *Maguire 33112* (holotype, US; isotypes, NY, US). Figure 6.

A *Nautilocalyce prophyrotricho* (Leeuwenb.) Wiehler foliis elliptico-oblongis basibus asymmetricis vel oblique obtusis vel rotundatis, petiolis longioribus, paginis inferioribus glabrioribus cum pilis parvis sparsim dispersis, pedicellis longioribus, bullis paginarum superiorum distantioribus.

Terrestrial, subsucculent herbs; stems short, only about 2 cm tall with densely sericeous shortened internodes, or elongated to 12 cm with internodes

Figure 5. *Nautilocalyx fasciculatus.* —A. Habit. —B. Flower with corolla removed. —C. Sepal margin. —D. Flower. —E. Corolla opened, with stamens after anthesis. —F. Corolla base with young stamens. —G. Ventral nectariferous gland. —H. Dorsal nectariferous gland. —I. Capsule with persistent calyx. —J. Seeds. (All from *Maguire, Cowan & Wurdack 29982.*)

Figure 6. *Nautilocalyx maguirei.* —A. Habit. —B. Flower. —C. Corolla opened, with stamens. —D. Flower with corolla and stamens removed. —E. Capsule with persistent calyx. (A–C, from *Maguire 33112;* D, E, from *Maguire 32736.*)

4.5–6 cm long, 4–6 mm wide and shortly pubescent. Leaves few at apex of stem, petiolate; blades elliptic-oblong to oblong-elliptic, 13–26 × 5–10.5 cm, shortly acute to shortly subacuminate at apex, base suboblique with one side usually obtuse to rounded or some leaves narrowed to an acute base, margin grossly subirregularly dentate from base to apex with 53–85 suborbicular to broadly ovate subobtuse to rounded teeth on each side, and most of lateral nerves or tertiary venation subprominent on lower surface, impressed on upper surface, lateral nerves 14–17 on each side, anastomosing near margin, adaxially bright green, bullate with large bullae 2–3 mm diam. surmounted by few to several short hairs, each upraised bulla bordered by a 4–6-sided reticulum faintly impressed, abaxially glabrous with short, sparse, spreading hairs on midrib; petioles 2.5–8 cm long, 2–3 mm wide, densely villous. Inflorescences mainly of 2–4 flowers in fascicles arising together at the apex of short stem or on an elongated portion of stem; bracts narrowly lanceolate, 4–6 × 0.7–0.8 mm, apex slenderly attenuate, densely appressed-pubescent; pedicels at maturity 2–6 cm long, densely villous with hairs 1.5–2 mm long. Flowers with calyx 6–13 mm long, tube 1.5–2.0 mm long, 5 mm wide at base, lobes subequal, narrowly lanceolate, 7–12 × 1.5–3.5 mm, apex slender acuminate and toothed, densely villous with ascending hairs on both sides from base to apex; corolla red, 3 cm long, tube 2.3 cm long, slightly gibbous at base dorsally, 7–8 mm wide toward mouth, ventrally glabrous for 2 mm, dorsally villous and densely appressed-pilose on rest of the surface outside, glabrous within except sparsely pilosulous for 2.5 mm at summit, lobes suborbicular, 6 × 8 mm, rounded, outside glabrous except appressed-pubescent at base of some lobes, inside glabrous; stamens included, filaments glabrous, anthers suborbicular, 1.2 × 1.1 mm, lobed at base; disc a dorsal nectariferous gland, oblong, 1.5 × 1.0 mm, subtruncate at apex; ovary ovoid, 3 × 2.5 mm, short sericeous, style 12 × 0.3 mm, glabrous. Fruit a globose capsule; seeds not seen.

Distribution. *Nautilocalyx maguirei* is known only from moist cliff faces and shaded banks on Cerro Guaiquinima in Estado Bolívar, Venezuela, at 1,000–1,200 m.

Additional specimens examined. VENEZUELA. BOLÍVAR: Cerro Guaiquinima, upper Río Paragua, 1,200 m, 27 Aug. 1943, *Cardona 903* (VEN), *Cardona 955* (VEN); base of second escarpment, 1,000 m, 21 Dec. 1951, *Maguire 32736* (NY, US).

Nautilocalyx maguirei differs from *N. porphyrotrichus* (Leeuwenb.) Wiehler, which is similar in habit, corolla color and calyx characters, but differs as follows: 1. leaf blades for the most part asymmetrically or obliquely obtuse or rounded, on at least one or both sides; 2. leaf blades elliptic-oblong or oblong-elliptic, but mainly broader; 3. petioles mainly longer; 4. lower leaf surfaces more glabrescent with short, more sparsely scattered pubescence on midrib and nerves, with the larger tertiary reticulum glabrous or nearly so, contrasted with a denser and longer pubescence on midvein and other veins in *N. porphyrotrichus* and resulting in an overall denser pubescence over the lower surface with smaller tertiary reticulum; 5. pedicels longer; and 6. bullae of upper surface more distant, the upper surface presenting a more glabrous aspect whereas the bullae in *N. porphyrotrichus* are more closely crowded, and the leaf surfaces are more densely pubescent.

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